RELATIONSHIPS WITH WATER
THROUGH
REGENERATIVE ARCHITECTURE

A community learning and swimming facility within Tolka Valley Park

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B. Arch. Thesis, 2022-2023

This topic was inspired by one of my favourite pastimes at home in Barbados.

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Last, but not least, I thank God for His grace, because without it none of this would be possible.

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[fig i] River Tolka (Tolka Valley Park) with all outfall locations highlighted

1 INTRODUCTION

INTRODUCTION

Personal position and presentation of issues

Water is a life-sustaining vital resource which influences human settlement, as well as our societal and cultural norms. The importance of historically locating near water bodies, such as rivers, has been reflected in our need for the element as an environmental amenity. The reduction of adverse health effects, amassing economic benefits (Fang and Jawitz, 2019), and the interpretations that we have made through art and religion, shape how we have come to understand water (Franz and Strang, 2016).

Gradually, the decline in our direct dependence on the proximity to such water bodies has caused us to become complacent, ignoring the increasing pressures we place on delicate ecosystems that thrive as a result of the presence of clean water. Strides on the efficiencies of man-made water infrastructure progressed in the name of urbanization and population growth. These instances of manmade infastructure, as well as out ability to physically and metaphorically turn our backs away from natural water sources, has resulted in a significant decline in its quality and deviations from its natural courses. This threatens what lives near and within. I believe that it is worth knowing that we are all interconnected through water and this interconnectivity facilitates a balanced ecosystem.

The chosen study locale is Tolka Valley Park, with the River Tolka being the principal water body for consideration. According to the Finglas Strategy Baseline Analysis Report 2021, increased use of the park is recommended. The water body is a fishing river but suffers from environmental challenges such as increasingly frequent flooding to the south-east of the park due to upstream over-urbanization and continued pollution from run-off and underground tributaries. The area between Blanchardstown, Tolka Valley, and Glasnevin is classified as slightly to seriously polluted according to The EU's Water Framework Directive.

To challenge the issue of diminishing river health, river restoration is employed as a modern practice (Speed, 2016). This requires an understanding of the relationship between the way a river functions and the demands and impacts people have on it. In the past, restoration initiatives were frequently conservation-focused efforts intended to preserve ecology while the construction industry focused on sustaining already damaged ecosystems. In more recent times, greater interaction with other facets of human development has become a hallmark of river restoration projects to manifest our interconnectivity within a balanced ecosystem. Recognizing the potential for restoration, in the form of regenerative design, can serve as a catalyst for urban renewal. Regenerative design is therefore a system of technologies and techniques that aims to renew rather than deplete underlying life support systems and resources within socio-ecological wholes (Mang, 2012). It is founded on a knowledge of how ecosystems operate. Regenerative architecture, by extension, is the practice of engaging the natural world as the medium for and generator of architecture (Littman, 2009).

Research aims

This thesis aims to investigate opportunities for human and river ecosystems to beneficially coexist through an architecture that is regenerative and operates using natural processes of water. How can human experience be used as an architectural intervention for river ecosystem regeneration? Who/what else is participating within the system? Can new-build architecture be appropriate within a natural context? Can it give as much or more than it takes? These are the questions which arise from my chosen topic to be tested by design. Development implies change, specifically modifying and adapting the landscape for human purposes (Lyle, 1994). This paper argues that it is possible for an architectural intervention to not succumb to the familiar notion that it involves the destruction of nature for human gain.

The thesis is organized into three main parts: concept and research, project and design, and reflections and conclusion.

Research objectives

This study, and design proposal by extension, has two main objectives:

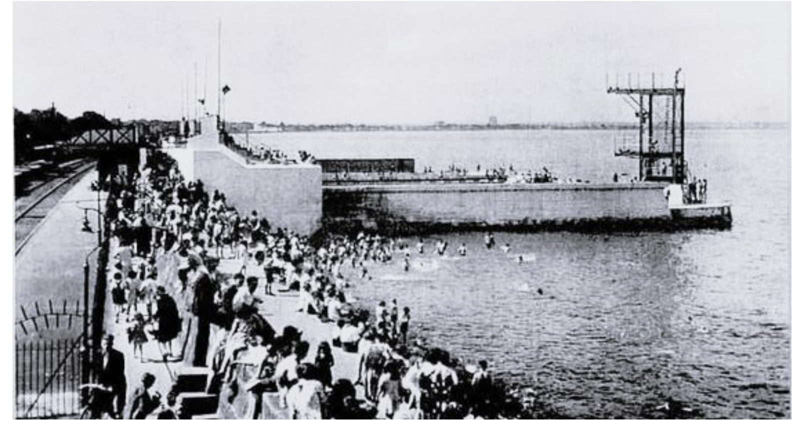
1. To enhance the relationship between humans, biodiversity, and water

2. To achieve this is in a way that is regenerative for all parties involved

Research was undertaken through site analysis, map databases, anecdotes, texts, websites, news and journal articles, architectural theories, and relevant case studies. Aspects of our cultural and sensorial relationship with water, frameworks for regenerative building, water's natural processes, as well as case study indicators were investigated. It is my hope that these topics will form a conclusive approach that achieves the aim.

2 CONCEPT & RESEARCH

[fig 1] Mother and son at traditional standpipe bath (left)
[fig 2] Man at community water storage tank (right)
[fig 3], Visit to Seapoint beach, Dublin
[fig 4, fig 5] Adjacent Blackrock Public Bath, in use, and now derelict respectively



CONCEPT & RESEARCH: OUR RELATIONSHIP WITH WATER

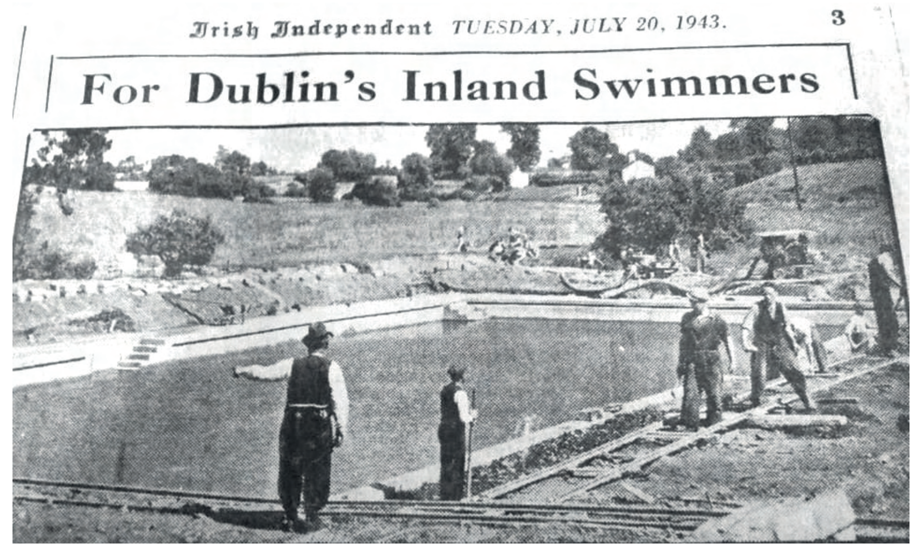
Personal experience

The thesis topic evolved from early semester images of interest in relation to sustainability. From my experience living in my home country of Barbados, there was a traditional culture (and still is in some rural areas) of collecting water from and bathing by a stand pipe. One would find stand pipes dotted around villages and communities and were an integral part of daily life before indoor running water became the norm. They drew their water from groundwater sources and were thresholds where people would congregate, whilst collecting water, for a chat or to simply assist each other. There were even some instances of children playing where ever they stood. In figure 1, it is common knowledge amongst Barbadians that a bath at a standpipe is one of the 'sweetest baths' (Beautiful Barbados, 2020). I experienced a few for myself so I can attest to this. It is exhilarating, and a cool way to relieve oneself from the scorching heat. In figure 2, this cultural and sensorial atmosphere is contrasted by a scene of a man, in recent times, accessing potable water through a government-provided community water storage tank. Barbados by its geographical nature lacks natural freshwater sources and depends mainly on rainwater to replenish aquifers and reservoirs. The country is also flood prone due to a lack in proper drainage and storm water infrastructure. Though the gesture of providing community tanks is a relief, I believe that it only served as a bandage for a larger problem. I then thought that this is what the idea of sustainability has become; doing "less bad", maintaining a current system without degrading another and without applying techniques to restore the original natural system (Littman, 2009).

Irish culture

Upon my temporary move to Ireland, I have come to experience and appreciate the year-round culture of icy swims, often along the coast or swimming holes (figure 3). This too, is an act of exhilaration and revitalization, awaking the mind. Irish folklore suggests that the effects of an invigorating swim improve the immune system and contribute to good health (Colley, 2012). It is common to see people congregating, having a chat, enjoying the atmosphere. Crisp sea air and the cool sand beneath bare feet suffices if disrobing is undesirable. Often, a hot tea or coffee comfortably concludes a plunge.

Historically, up until the 19th century the concept of public baths was common in Dublin, especially in the inner city, for the purposes of washing oneself and one's clothes. Seawater public baths became popular and synonymous with recreation and promenading. They even drew crowds for events such as galas. The pools were often surrounded by concrete walls within the sea to catch tidal flows, making a safe threshold. Blackrock Bath was one such example (figure 4, 5) and has been derelict since the late 20th century due to cutbacks and the growing popularity of indoor heated pools (Grainger, 2022).



(Left to right)
[fig 6] Outdoor Cabra bath under construction
[fig 7] Cabra bath open and in use
[fig 8] River Tolka "Silver Spoon" spot near Cardiff's Bridge
[fig 9] Fresh water mussel shell

"Oh the Silver Spoon holds many charms that draw young lovers there.
It excites them in mysterious ways, and takes them in it's care.
It's waters flow beneath a bridge, where fragrant flowers bloom,
That invites young lovers to walk out, down by the Silver Spoon.
Yes it invites young lovers to walk out, down by the Silver Spoon."
- "The Silver Spoon" by Brendan Devereux

Cabra Bath, Tolka Valley Park, Late 1930s

Within the study locale of Tolka Valley Park, Dublin, there occupied a public outdoor swimming pool built by Dublin Corporation in the late 1930s (figure 7-10). It was where children gathered, and was fed by the water of the river (The Museum of Childhood Ireland, 2019). Children even bathed in an area of the river called the Silver Spoon (Coffey, 2011). Older residents of the Finglas and Cabra area remember this area fondly and reminisce on the days of youth: gathering, swimming, playing and sometimes even romantically promenading according to a song called 'The Silver Spoon' by Brendan Devereux. My landlord, an elderly gentleman, shared an old fresh water mussel shell with me that he had collected when he was young. He recalled wild swimming and mussels were aplenty underneath his feet.

By the 1960s, the people of Cabra west became concerned about the pollution leeching into the river from the then adjacent operating landfill, as well as seagull droppings and as a result, the pool closed and today there is no sign of remains (figure 11). The disappearance of the inland bath was also due to the growing popularity of indoor heated pools.

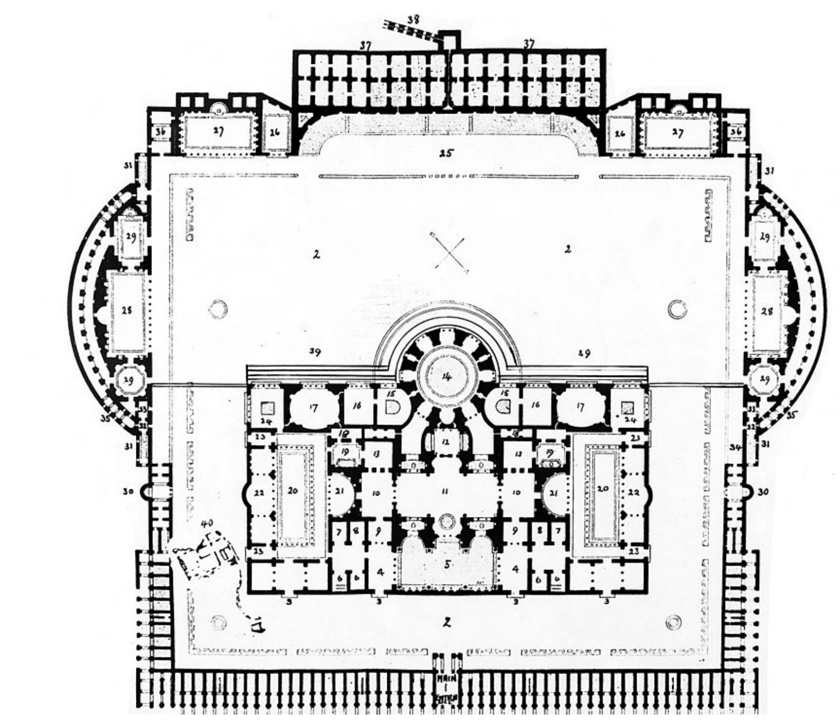
Culture prevailing

During the COVID-19 pandemic, there was an uptick in individuals interested in sea swimming according to CSO 2022 statistics (see Appendix A). 55% of respondents spent more time outdoors, with 21% taking up sea swimming. In addition to this, several news articles at this time featured individuals who proudly manifested their desire to swim at home in their own backyards by way of natural swimming pools. This is an inexpensive, environmentally friendly way to eliminate the need to travel far distances or plunge into chemical filled, sometimes non-atmospheric indoor swimming pools. The power lies in naturally harnessing rainwater and filtering it, through a process of phytoremediation, in a closed loop regenerative system (McGuinness, 2020). Therein lies an opportunity to revive inland swimming.

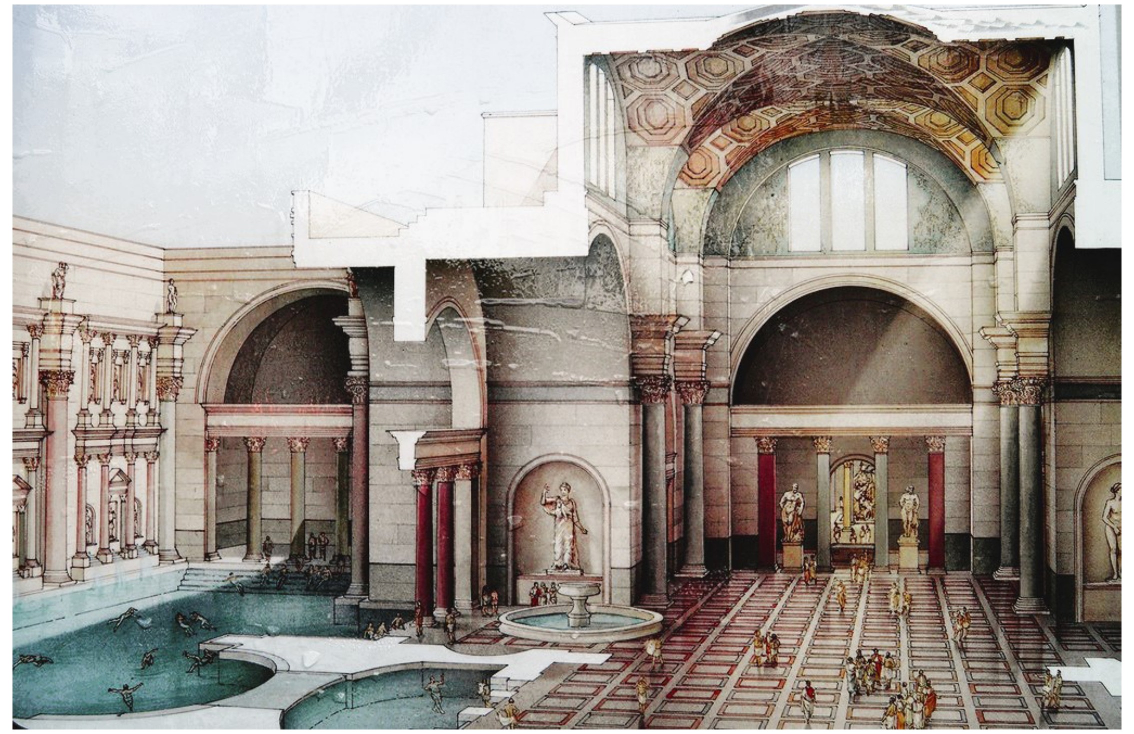
Tolka Valley Park today

Further analysis shows that River Tolka provides a line of demarcation within the park, dividing the northern activity for pitches and a playground, and southern activities which consist of a quieter, more passive, contemplative nature like a stroll, dog walking, and seating on benches (figure 13). The river unassumingly babbles on in the centre.

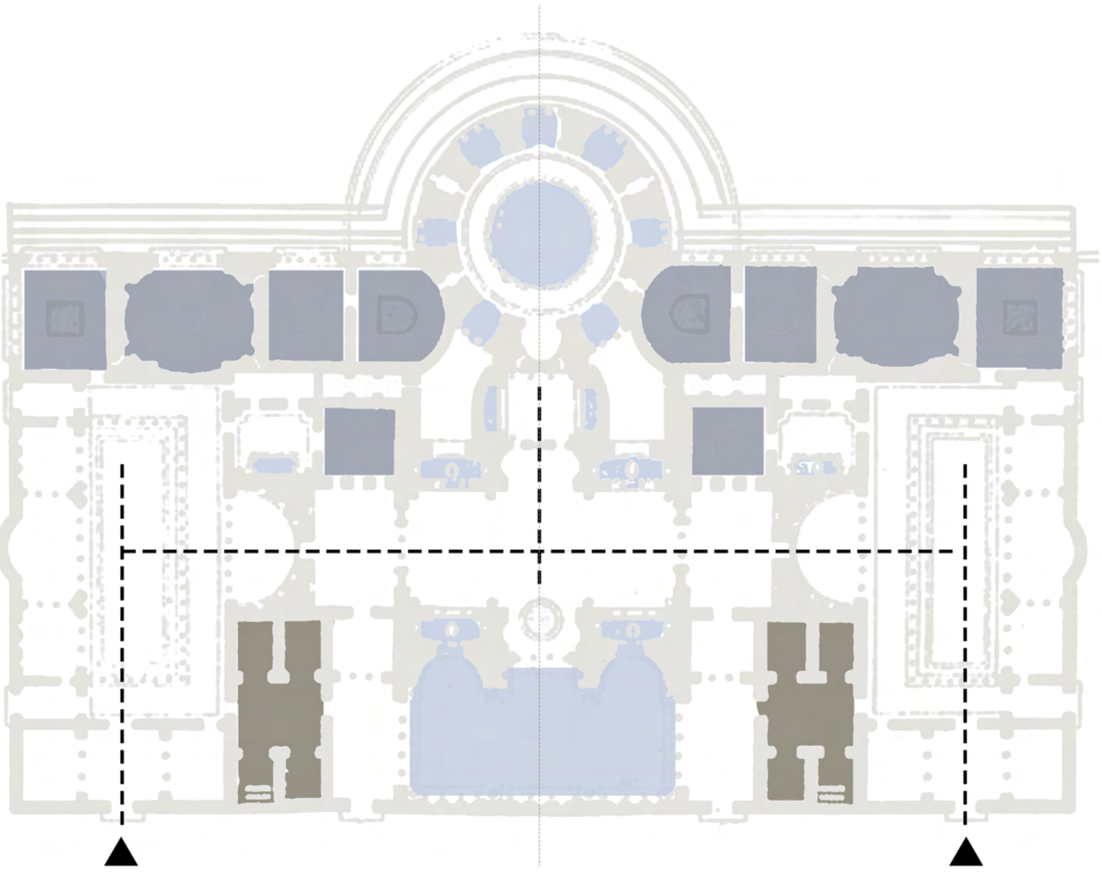
(Top to bottom)
[fig 10] Cabra Bath opening 1937 OS 6 inch series map: Cabra bath highlighted within Tolka Valley Park south of River Tolka
[fig 11] 2018 map: Visible development in surrounding areas, no pool remains
[fig 12] Satellite image of Tolka Valley Park today
[fig 13] Existing activity zones highlighted



1. Main Entrence.
2. The Great Court.
3. Four Entrances.
4. Vestibules of the Frigidarium.
5. Frigidarium.
6. Apodyterium - undressing rooms.
7. Conisterium - sand for wrestlers.
8. Eleotesium - oiling room.
9. Conversation Halls.
10. Halls for wrestlers and spectators.
11. Sphaeristerium - Grand Hall of Tepidarium.
12. 2nd Tepidarium - vestibule of Tepidarium.
13. Courts for the bath service.
14. Calidarium.
15. Halls of Transition (Calidarium - Tepidarium).
16. Halls of Transition (Tepidarium - Frigidarium).
17. Uncovered halls for athletics.
18. Small warm rooms, leading to -
19. Sudatorium - hall for inducing perspiration.
20. Peristyles (Palestrae) wrestlers, gym, etc.
21. Exedrae. Philosophers, rhetoricians, scholars.
22. Ephebeum - for beginners at gym.
23. Four secondary entrances.
24. Lutron - cold baths for those using -
25. Xystum - open space for running, gym, etc.
26. Uncovered halls for use of Xystum.
27. Library halls; one for Greek; one Latin.
28. Palaestrae - uncovered gymnastic games.
29. Halls for academic discussion.
30. Exedrae - Philosophers meeting places.
31. Staircase to next floor.
32. Vestibule.
33. Conisterium - sand for wrestlers.
34. Mithraeum - Temple to God Mithras.
35. Porticoes for gymnastic teachers.
36. Two staircases.
37. Two storied reservoir.
38. Large aqueduct.
39. Subterranean galleries for summer promenades.
40. House of Asinius Pollio.



[fig 14] (left), [fig 15] (right) Baths of Caracalla, Rome, 212 AD



[fig 16] Analysis diagram

Themes of focus

The previous mentioned human experiences and research revealed themes that manifest themselves in physical spaces throughout history and the present day. The three main themes of focus are:

1. Sense of place,
2. Aesthetic values, and
3. Social relations.

These themes relate to people's relationship with each other and their respective water landscapes.

Firstly, a sense of place refers to ideas of place identity, the spirit of a place and a sense of belonging. The theme involves components and activities of a social-cultural landscape which increases the uniqueness of a space (Guizzo and Chan, 2018). An example was the concrete headed stand pipes in Barbados - unique to villages and elicited good memories and a love for home. Another example was the aspect of recreation and spirituality of the natural environment as seen in the Irish culture of sea bath swimming within concrete pools positioned with care in the unpredictable sea. A cold plunge revitalized the body, mind and spirit.

Secondly, aesthetic values refer to exploration of the nature of beauty through our senses and emotions (Guizzo and Chan, 2018). According to research, 83% of the information we receive is provided by sight, 11% by hearing, 3.5% by smell and 1.5% by touch (Medina, 2008). Contact with the natural environment, with a particular focus on water, can reduce stress and mental fatigue, improve concentration, and regulate emotions (Kaplan and Kaplan, 1989).

Thirdly, social relations, with regard to connections to neighbourhood landscapes, refer to the involvement of natural or green spaces with the daily routines of residents to use, enjoy and build strong community bonds (Chua, 2018).

Expressions of themes in architecture

My interest in the cultural experiences of bathing and swimming led me to become inspired by the typology of the Bath of Caracalla in Rome, built in 212 AD. Other architectural expressions of the focal themes are examined in Peter Zumthor's 2011 Serpentine Pavilion, and Gustafson Porter and Bowman's Diana, Princess of Wales Memorial Fountain.

The Bath of Caracalla was an architectural marvel of the day and one of the best of its kind. It mainly served as a complex of spaces for cleansing the body, as well as providing facilities for other activities such as reading in libraries, exercising in the stadium, as well as meeting, promenading, and shopping in the stoa, which wrapped around the entry façade. The baths were an integral part of ancient

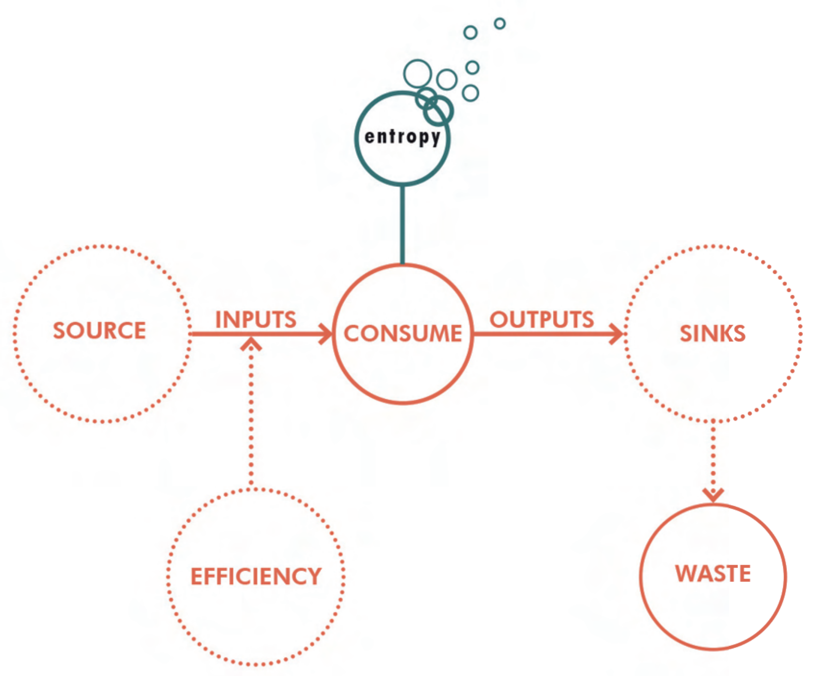
[fig 17] Serpentine Pavilion 2011, Peter Zumthor

[fig 18] Diana, Princess of Wales Memorial Fountain

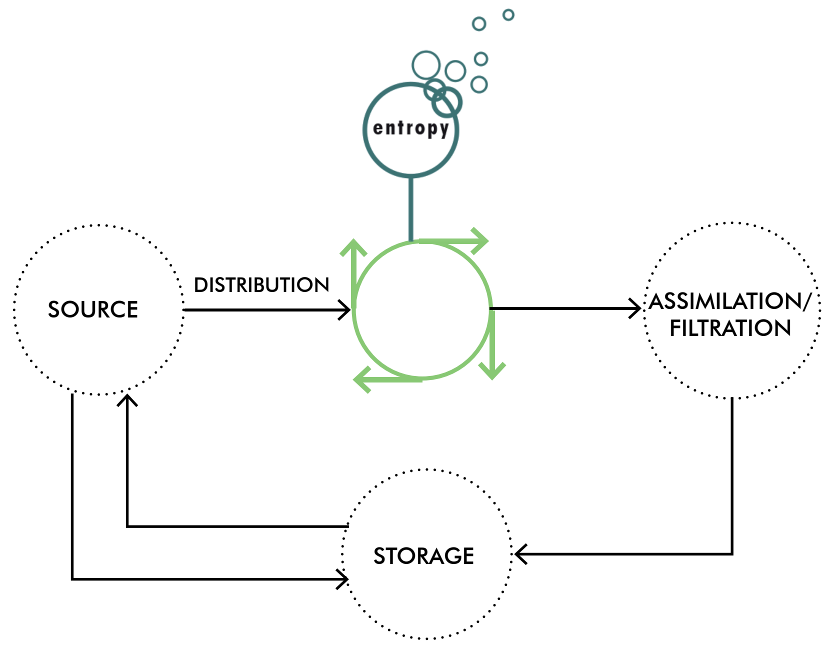
Roman culture, providing a positive sense of place and feelings of grandeur from high ceilings, whilst possessing a liminal quality when moving through transitional halls. It accommodated 10,000 people daily and possessed various types and temperatures of pools. The building footprint has a strong symmetry with a caldarium (hot room) and a frigidarium (cold room) on the far ends of the central axis. A grand hall was located in the middle of the scheme. One entered on either side of this central axis through the entrance halls and open exercise spaces. Servant spaces, such as changing rooms, were conveniently located near the entrances and exercise spaces, and the approach towards the centre was made clear by the use of columns as opposed to solid walls. Gallons of water constantly supplied the bath daily through an aqueduct from groundwater, springs, and lakes. Additional inlets of water were stored in reservoir cisterns to supplement flow during daily operating hours (Deming, 2020). Bathed water was eventually used to flush toilets, before flowing through the Cloaca Maxima, a sewage system, and out to the Tiber River.

Aesthetic value is exemplified in the 2011 Serpentine Pavilion by Peter Zumthor by way of uniquely engaging the senses of individuals who move through and inhabit the space. The scale of the architecture is not grand but I believe that the impression it leaves is. The outside facade of the dark stained timber pavilion is unassuming, but the openings invite exploration. One walks through a narrow, dim liminal space and is guided by natural light towards the courtyard in the centre which incorporates a rain garden. One is not meant to traverse across the garden but stay within the zone of the open cloister. One is free to promenade, contemplate or socialize as they see fit. The central rain garden receives sustenance in times of rainfall, creating a wild, green, and comforting oasis. The human senses are stimulated. The rain drops are heard as they fall on to the sloped roof and a veil is seen as it cascades off. In Zumthor's statement he wrote, "…I think of gardens that I have seen, that I believe I have seen, that I long to see, surrounded by simple walls, columns, arcades or the façades of buildings – sheltered places of great intimacy where I want to stay for a long time".

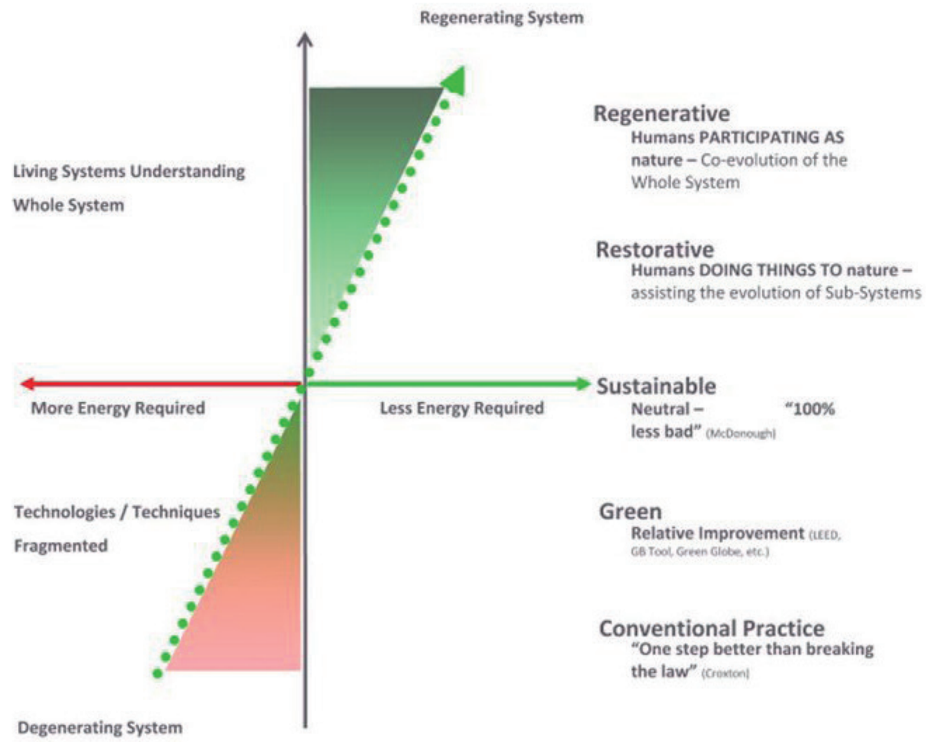
Gustafson Porter and Bowman's Diana, Princess of Wales Memorial Fountain is an example of landscape architecture which shows aspects of social relations in conjunction with the landscape. The memorial is a shallow, granite, oval feature of water set lightly across the existing contours of the park site. The feature uses the topography to divert the water downhill in two directions across deliberately textured stone. The water cascades, bounces, rolls, swooshes, and bubbles along the path until it ends its journey in a reflective basin at the lowest point (Landezine, 2014). The fountain encourages contemplation, leisure, socializing and forms of play in people of all ages.



[fig 19] Existing systems, degenerative linear flows



[fig 20] Regenerative closed loop system



[fig 21] The trajectory of environmentally responsible design

CONCEPT & RESEARCH: REGENERATIVE ARCHITECTURE DEFINED

"Environmental design is where the earth and its processes join with human culture and behaviour to create form". - Lyle, 1994

History of sustainable paradigms

Before the concept of regenerative architecture, there have been a number of sustainability paradigms which influenced architecture in the 20th and 21st century (Attia, 2018) (see Appendix B). Dating back to 1906 with the concept of bioclimatic architecture to sustainable architecture in the 80s and 90s, each paradigm focused its architecture on main ideas such as discovery, harmony, energy efficiency, resource efficiency, neutrality and resilience - all with regard to the environment. The most recent paradigm for discussion and debate is regenerative architecture, which focuses on the idea of recovery.

A new standard

According to RIBA Architects' Built for the Environment Report, regenerative design is defined as a system of technologies and techniques that aims to renew (figure 20) rather than deplete (figure 19) underlying life support systems and resources within socio-ecological wholes (Pierson, 2022). It is founded on a knowledge of how ecosystems operate. Regenerative architecture, by extension is the practice of engaging the natural world as the medium for and generator of architecture (Littman, 2009). The concept of regenerative design is a relatively recent one within the industry, with John Tillman Lyle, a landscape architect, being the first individual to publish a comprehensive guide in 1994. It is sometimes confused for the more common and familiar term, sustainability, but upon further research the latter concept lacks in its approach. Numerous articles within the construction industry reiterate that the sustainability practice alone aims no higher than making buildings "less bad". Buildings are often designed in isolation to the ecosystem that it is a part of, as opposed to having integrated parts which seek to mimic restorative and replenishing aspects. Regenerative architecture subsequently becomes an extension of a place, and the natural ecosystem. (Gattupalli, 2022). When architecture is treated as part of nature it is thus set up to produce vital resources like clean water, food, and energy. If a building can produce and store energy on-site, for example, in order to have little to no reliance on a utility grid, it could potentially serve as a small-scale energy resource for the surrounding community, further reducing reliance on the larger utility.

Although they are not mutually exclusive, the ideas of sustainability, restoration, and regenerative design must be distinct (figure 21).

Quality improvement in sustainable design is done with the intention of doing no damage. Design that is restorative returns the potential of the neighborhood to a stable state. Regenerative design is a paradigm in which people participate in and consider how their immediate surroundings are co-evolving. We can only fairly relate to one other in the context of our locality. This culminates into John Lyle's twelve strategies for regenerative design, which are the basic conceptual applications that must be considered. These include:

1. Letting nature do the work
2. Considering nature as model and context
3. Accumulating, not isolating functions
4. Seeking optimum levels for multiple functions
5. Matching technology and need
6. Using information to replace power
7. Providing multiple pathways or means
8. Seeking common solutions to disparate problems
9. Managing storage as a key to sustainability
10. Building form to facilitate flow
11. Building form to manifest process
12. Prioritizing for sustainability

It is my hope that the proposed design is anchored in the majority, if not all of the mentioned strategies.

Good
Moderate
Poor

[fig 22] River water quality highlighted (according to the Water Framework Directive Report 2013-2018)

[fig 23] (left) Location plan of Tolka Valley park.
Wetland highlighted with path of culverted outfall for treatment before entering the River Tolka

[fig 24] (bottom) Section drawing through Finglas residences, culverted outfall, Tolka Valley Park's constructed wetland and Dublin Industrial Estate

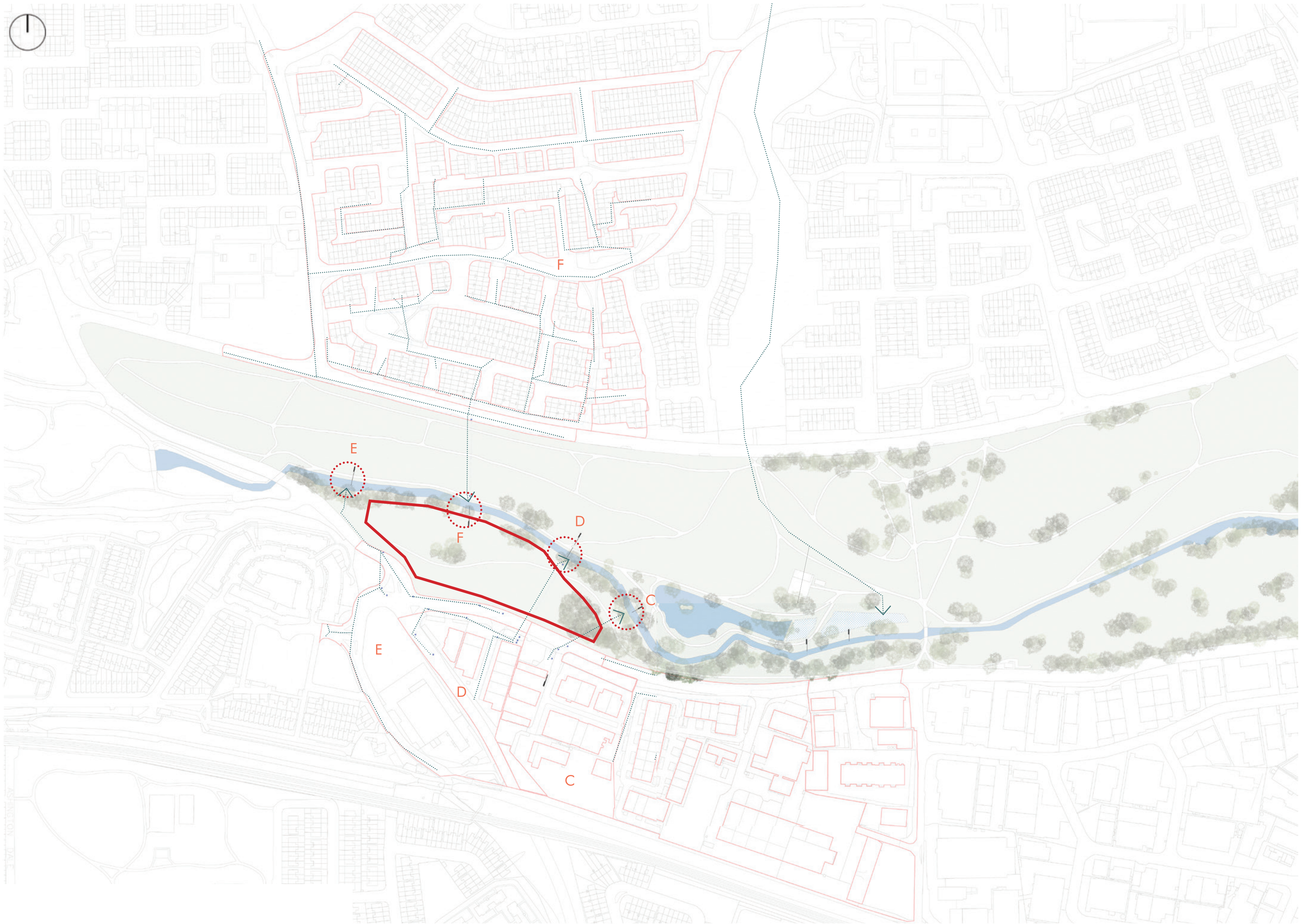
CONCEPT & RESEARCH: WHOLE SYSTEMS THINKING

"A regenerative system provides for continuous replacement, through its own functional processes, of the energy and materials used in its operation." - Lyle, 1994

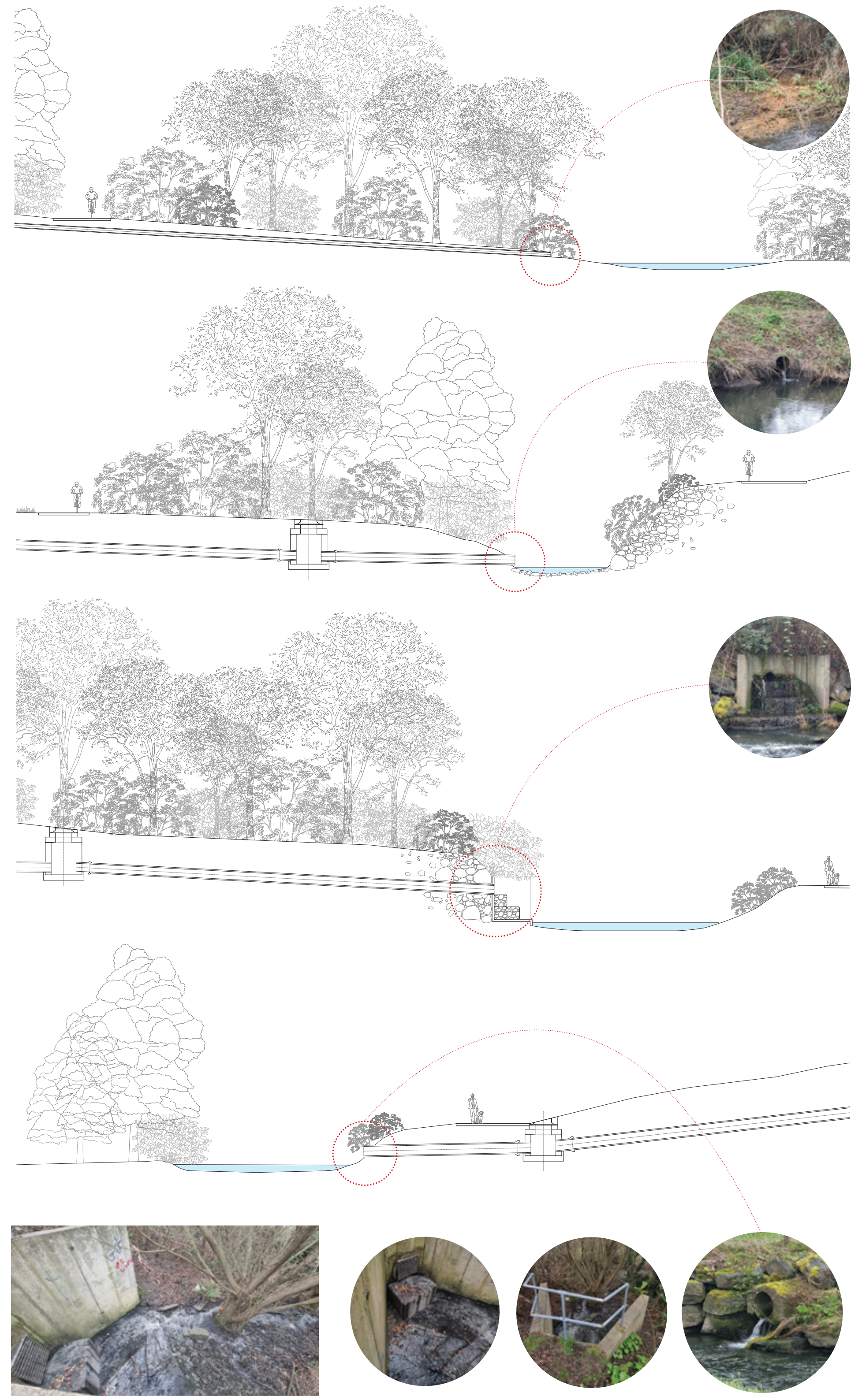
Regenerative design is fundamentally built on the idea that there is no separation between people and nature. It is founded on the concept of whole systems thinking, according to which everything is interconnected and contributes to the overall health of the system. Whole systems thinking results in design that is completely comprehensive and inclusive. (Littman, 2019)

All important and contributing entities must be taken into account, with their networks of effect on the broader ecosystem being measured. The design must consider how a building interacts with the microclimate. The planned system must allow for mutually beneficial connections between entities, with equal give and take. Each interaction reinforces the others, resulting in a robust, thriving human-nature ecosystem. The initial phase of regenerative design begins with a further site analysis of Tolka Valley Park to glean a collection of patterns and interconnected systems.

In 1999, an intervention in the form of an integrated constructed wetland was introduced to address foul drainage misconnections and domestic effluents from the northern Finglas housing area (figure 23 and 24). The project aimed to attenuate pollutants and reduce malodors in order to enhance the amenity value of the site. The resulting new park pond became a home for native biodiversity such as: kingfishers, brown trout, and willow, just to name a few. With professional monitoring, it had been documented that this strategy was successful in intercepting untreated out-fallen water, filtering it before entering the river Tolka. Though this was a success, it is only in isolation. The River Tolka, in this area, is unfortunately categorized according to the Water Framework Directive report 2013-2018 as in a poor state (figure 22). This can be attributed to polluted runoff from surface storm water, upstream agriculture, and over-urbanization.



[fig 25] Site plan showing drainage and outfall locations



[fig 26] Sections C, D, E, F respectively. Additional photographs at outfalls.

Tolka Valley Park possesses a total of about 12 surface gravity mains with outfalls which lead directly to the river (see highlighted public drainage map in appendix C). For the most part, water flowing through these mains are from rainfall which carries any impurities from varying surfaces along with it. Also important to note, according to the Dublin City Council, as a rule of thumb, 3-4% of housing are misconnected to the surface water network. Within the site of interest, there are 4 surface water outfalls from the northern Finglas residential area and southern Dublin Industrial Estate areas, flowing towards the river (figure 25). The conditions at each point were photographed and drawn in section according to DCC drainage map locations, with respective manhole invert levels shown (figure 26). These conditions are often unapparent to humans; but can have a negative impact on other participants within this delicate system (figure 28). This out-fallen water is a form of entropy, which can further manifest itself in the growth of sewage fungus and poor water quality. It is my belief that each outfall should be intercepted by strategically placed regenerative methods of sustainable urban drainage (SUDs), whilst also providing a recreational amenity to the community. Chapter 9.5.2 (Natural Watercourses & Water Quality) of the Dublin City Development Plan, outlines relevant objectives in SI08 and SI09 (see appendix D) which align with my proposal. These sections relate to the need for river restoration strategies to improve the river corridor, addressing water quality, ecology, and amenity, as well as planning for surface water management.

Who/what participates within the system?

For any context, it is important to know the participants within a local ecosystem, as well as the landscape. Since the river is the location of focus, alluvium subsoils were found, indicating that the area's ground water is vulnerable and particular care must be taken in design against the disturbance of an existing ecosystem (figure 27). The aforementioned humans who occupy the park, as well as the animal life and plant life, are all intricately dependent on water's regenerative processes (figure 29). Their particular habitats and relationships with water were taken into consideration during the design process (see appendix D).

[fig 27] (above) Subsoils highlighted. The immediate site on either sides of the river is characterized by Alluvium, highlighted in orange.

[fig 28] Dead fish on river bed due to sewage effluent

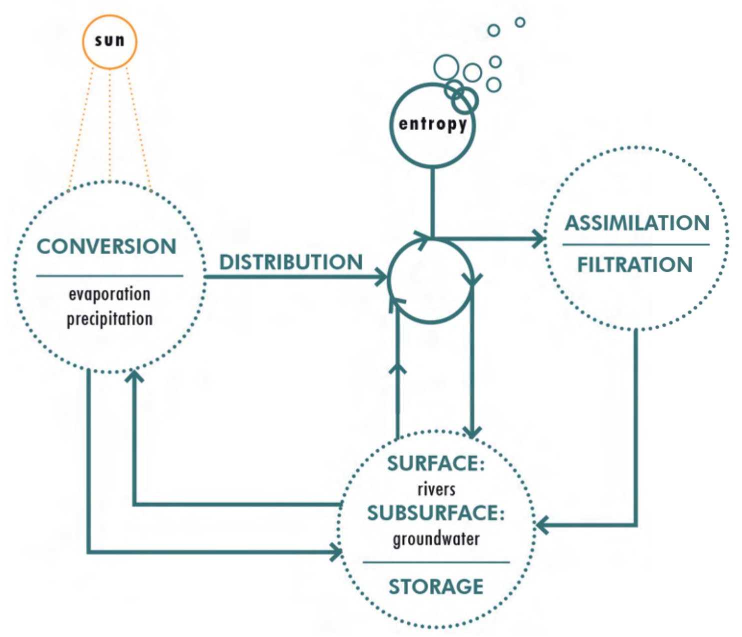
[fig 29] (bottom right) Participants of within the site's ecosystem

Species of interest:

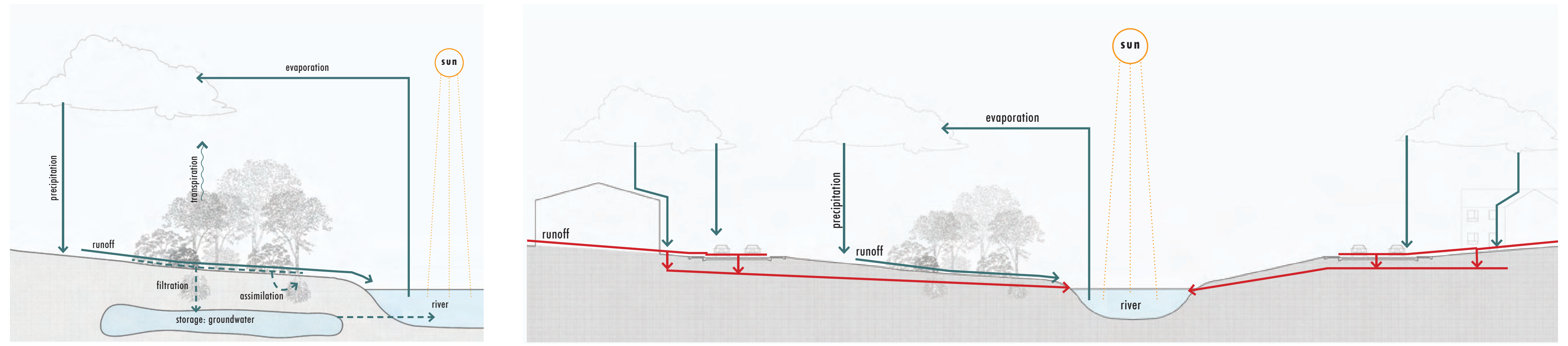
Flora:
1.Wild flower meadow (Native)
2. Aquatic plants (Introduced)
3. Birch (Native)
4. Ivy (Native)
5. Ash (Native)

Fauna:
6. Otter (Protected)
7. Daubenton bat (Protected)
8. Kingfisher (Protected)
9. Minnow (Native)
10. Hedgehog (Protected)
11. Common frog (Protected)
12. Moorhen (Native)
13. Monarch butterfly (Native)
14. Honeybee (Native)

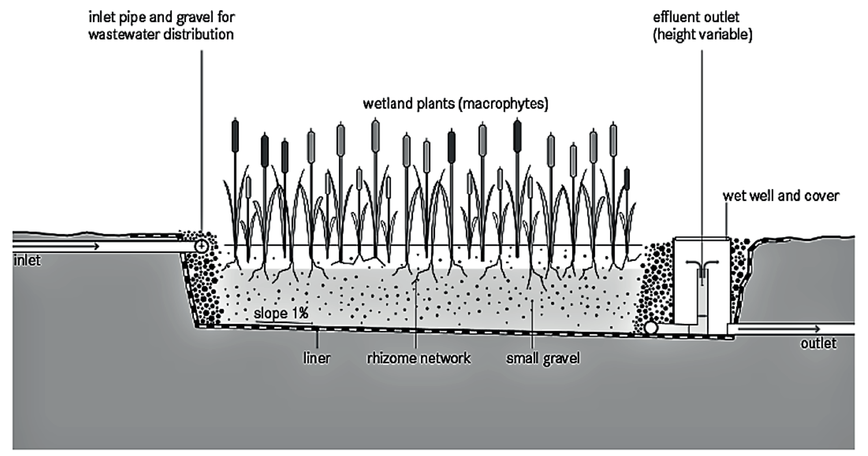
Human:
15. Students and staff
16. Residential community
17. Researchers



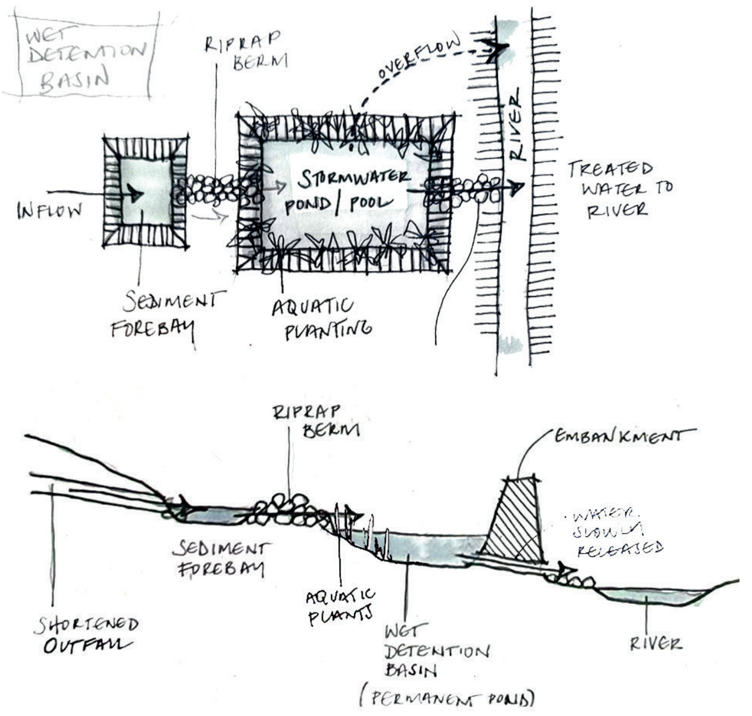
[fig 30] Basic processes of regeneration, with water as the focus



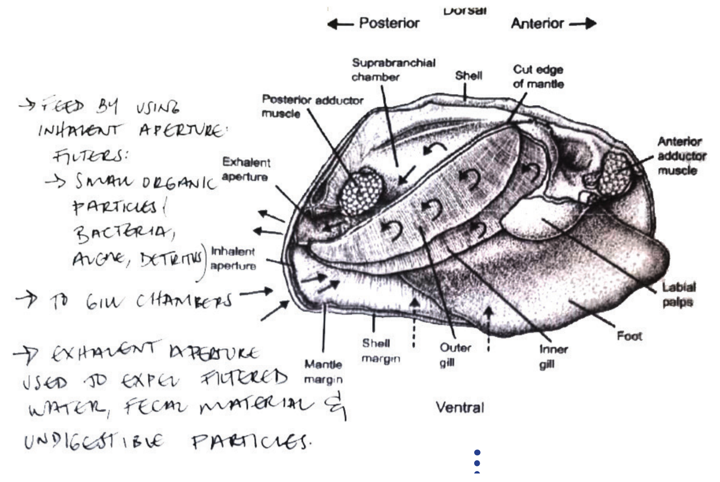
[fig 31] (Left) Natural processes of water regeneration through the typical hydrological cycle. (Right) The hydrological cycle applied to site with intervening surface runoff to river



[fig 32] Typical diagram of an integrated constructed wetland



[fig 33] Early sketch of a wet detention basin



[fig 34] Anatomy of a fresh water mussel

CONCEPT & RESEARCH: REGENERATIVE PROCESSES OF WATER

The basic process of regeneration for water is a closed loop system within nature (figure 30) It is easily understood through the hydrological cycle (figure 31, left) which involves conversion by the sun's energy into evaporation and precipitation. It is then distributed to reach members of an ecological community, spread over a landscape, into forms of assimilation (a return to the landscape), and or filtration. From the distribution or assimilation/filtration stage, water flows into waterbodies, groundwater, or other forms of storage. This cyclical distribution may continue before entering the conversion state once more.

Both the present linear system and hydrological cycle can become intervened by the concept of entropy. Entropy is defined as a measure of disorder or chaos on a system. In the case of water, if a foreign compound is dumped into good quality water, it is likely that the compound will be dissolved and diffused into the whole water body. An increase in entropy results in water pollution, thus impacting the environment (figure 31, right).

Biofiltration - Phytoremediation

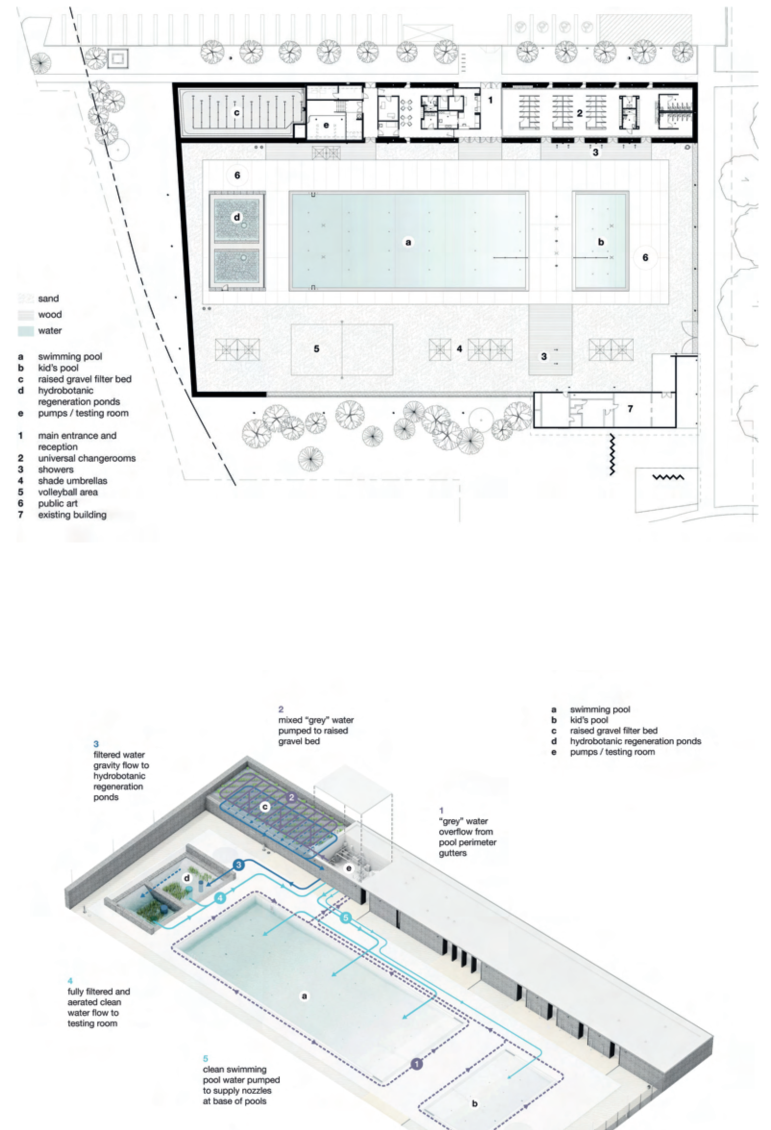
Recalling the presence of the integrated constructed wetland within Tolka Valley Park, it was learned that its species of plants, such as reeds and bulrushes, were effective at purifying large inflows of water through its roots and filter substrate system (figure 33). In a natural system, wetlands function in this way. Regeneration naturally occurs through phytoremediation, a process which works with the natural capabilities of plants to repair toxic soils, groundwater and surface water (Earthrepair, n.d.).

An integrated constructed wetland is a SUDs component and proves to be capable of producing a rich habitat for biodiversity. Its outfall interception inspires smaller scaled ones for outfall points C, D, E and F (see figure 25). A wet detention pond may be appropriate in doing so, temporarily attenuating and filtering water through its vegetated shelves before it is slowly released back into the river (figure 34).

Biofiltration - Filter feeders

The anecdote of fresh water mussels found in the river was recalled. They are categorized as filter feeders in the animal kingdom and feed on suspended matter and food particles from water, often by running the water through their specially designed filtering anatomy (Studocu, n.d.). Mussels are an integral part of a fresh water ecosystem as they naturally filter impurities. Water is inhaled towards its gill chambers and filtered water, faecal matter and indigestible particles are exhaled. When water is overwhelmed by varying forms of entropy, mussel populations die out, leading to one less participant within an otherwise balanced ecosystem.

CONCEPT & RESEARCH: CASE STUDY 1: BORDEN PARK NATURAL SWIMMING POOL



[fig 35] (Above) Scheme floor plan. (Below) Strategic diagram

Borden Park community swimming facility in Canada is an appropriate building typology for consideration with regard to scale, purpose, regenerative application and materiality. The project features a pool house for changing and equipment, a large outdoor swimming pool, a children's swimming pool and an area for other leisure activities such as volleyball and lounging (figure 35). The project can accommodate the activities of about 400 swimmers.

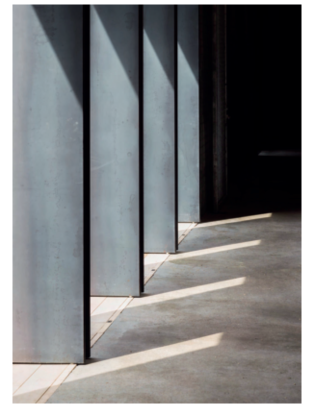
The pools are characterized as natural swimming pools because of their ability to filter water using a system of zooplankton plants, gravel and sand instead of the use of chemicals. This system mimics the natural regenerative process of water where the bathed or grey water overflows from the pool, is pumped to a gravel/sand bed to trap large particle impurities, then further filtered through phytoremediation in a "hydrobotanic regeneration pond", then to a room within the building for testing, and finally pumped back to the pools as clean water.

The facility provides a sense of place. It became a replacement for a mid-century modern pool building which had existed in its location in the 1950s. At the time, civic outdoor bathing pavilions were a vital part of cultural heritage and now that culture is being maintained.

With regard to aesthetic values, visually, the project's pools do not possess an organic look and feel, despite its natural processes. Instead, they, as well as the building's form, are defined by sleek straight lines in plan and elevation, paying homage to the civic bathing pavilions of old. Materially, the facade is made up of dark limestone gabions, recalling the concept of natural filtration.

The aspect of social relations comes by way of its very location. The project is sited within Borden Park, a place of shared outdoor recreational activities, family gatherings and outdoor bathing since 1942 (Roma Publications, n.d.) Prior to construction, community consultations were conducted and a natural pool was the request that resulted.

[fig 36] Exterior

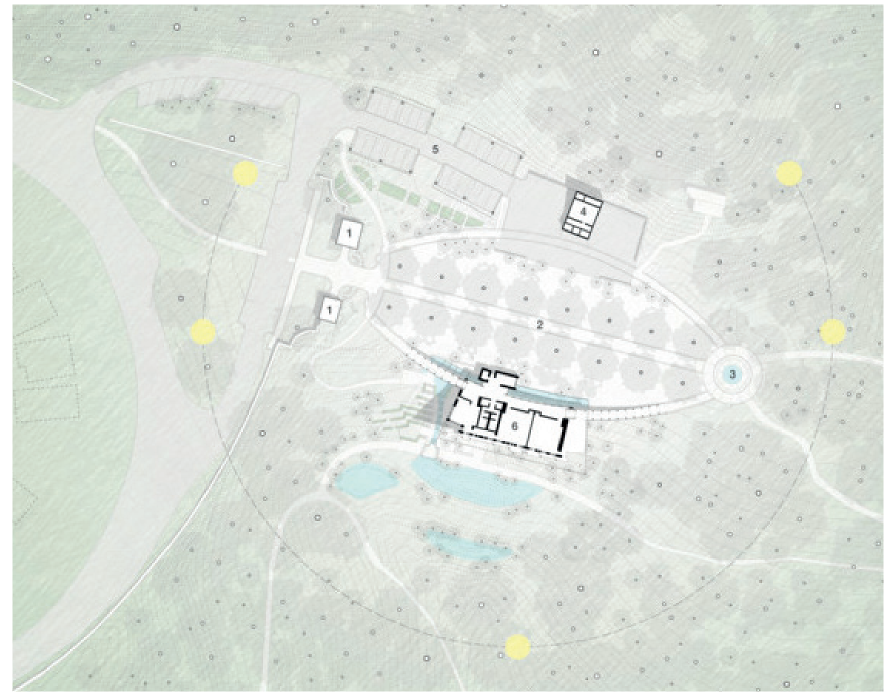


[fig 37] Interior

[fig 38] Regeneration pond

CONCEPT & RESEARCH: CASE STUDY 2: FRICK ENVIRONMENTAL CENTRE

[fig 39] Exterior



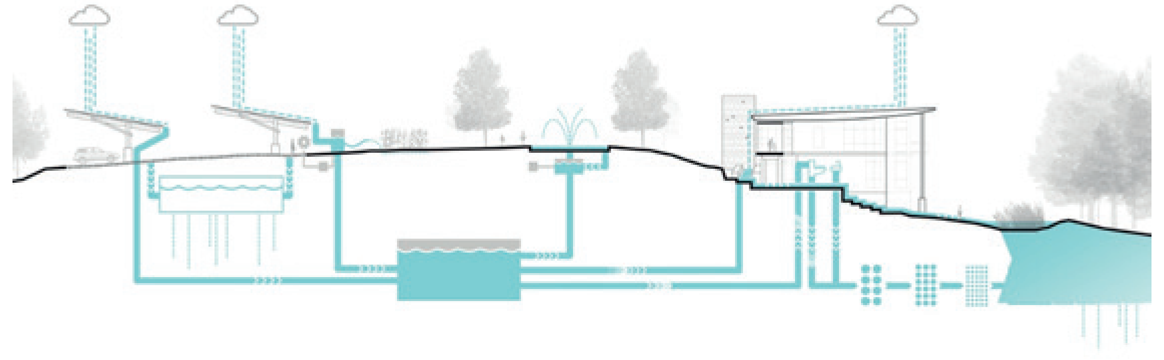
[fig 40] Site masterplan

The Frick Environmental Centre, USA, is an exemplar of the focus themes: sense of place and social relations. It is described as a hub for community events and learning opportunities. The centre was envisaged by the locals as a larger, more practical space for gathering, since their previous was destroyed by fire. The project evolved from an attention to contextual and local identity. It is a conduit to the surrounding park and woodlands, and offers children, as well as adults, opportunities to physically learn about their locality, as opposed to only demonstrations (figures 39 and 40).

The building includes a public living room, gallery, flexible multisensory indoor and outdoor learning spaces, and an amphitheatre. It is self-sustaining, with a clear system for building-use water collection and filtered output back to the park (figure 41). Renewable energy sources by way of solar power and ground source heat pumps are incorporated. Aesthetically, the project takes advantage of water's animation through veils which cascade off the roof during rainfall (figure 42), and a central fountain.

The centre works with schools to engage students through tailored stewardship programs. Most importantly, the design is recognized as regenerative and is "Fully Living" certified by the International Living Building Institute. It satisfies the following vital imperatives for regenerative design and certification:

1. Habitat exchange
2. Net zero water
3. Ecological water flow
4. Net positive energy
5. Biophilia
6. Democracy and social justice
7. Beauty and spirit
8. Inspiration and education.
9. Embodied carbon footprint
10. Responsible industry, appropriate sourcing
11. Conservation and reuse



[fig 41] Water management schematic

[fig 42] Roof water veil

3 PROJECT & DESIGN

[fig 44i] View 1

[fig 44ii] View 2

[fig 43] Key plan with chosen site highlighted in red

[fig 44iii] View 3

[fig 44iv] View 4

[fig 45] Location X - DCC information board

[fig 46]

[fig 47] Existing site section A-A

PROJECT & DESIGN: **BRIEF**

The chosen site is situated within the south-west quadrant of Tolka Valley Park (figure 47).

Its characteristics include a slight slope approaching the river on both sides, different species of riverine trees on the south side of the river, a hedgerow south of the foot path and wild flower meadow in the centre (figure 43-46). The site is quiet despite being downhill from Dublin Industrial Estate and a traffic junction.

The existing approach is east from Ballyboggan Road or west from Cardiff's bridge. Existing connections to the north side of the park and river from the proposed site is only done via a footbridge in the centre of the park from Ballyboggan Road or the upper entrance from Cardiff's Bridge.

One information board relating to the seasonal wild flower meadow and its benefits to fauna was found nestled amongst bramble along the southern most footpath, closest to Ballyboggan Road. From my observation, this footpath seems to be the least travelled for park users. This information board would be of better benefit to people if there were perhaps more of them with more information and closer to the respective habitats.

According to the Finglas Strategy, Baseline Analysis Report, there is a current need by the community, for facilities to combat anti-social behaviour in youth, erase the perceived divide between localities due to the valley's edges, and liven up the desolate nature of the Tolka Valley. It must be noted that this must not come at the expense of the existing river ecosystem.

To explore and test the themes that emerged from the researched relationships with water and its regenerative processes, an ecological laboratory fit for 36 to 54 students, a community cafe and swimming facility, to accommodate approximately 300 bathers, are proposed.

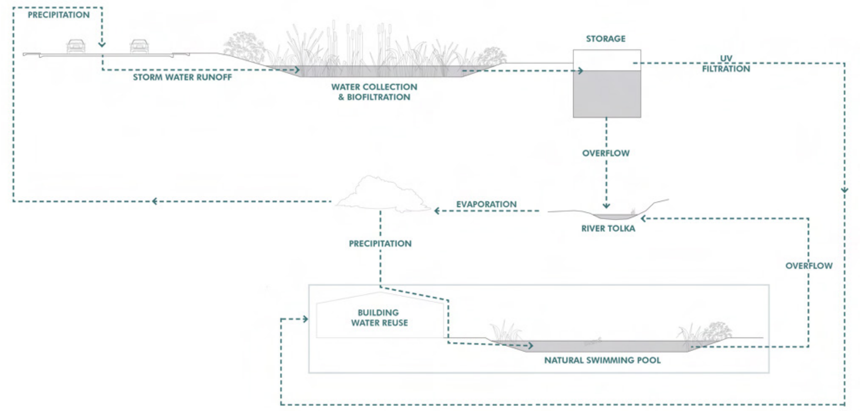
The design will act as a extension to the existing ecosystem, manifesting as a treatment interceptor between untreated surface water run off and the river Tolka, as well as a public amenity for education and monitoring, and recreation (figure 48).

The objectives of my topic and design proposal are:

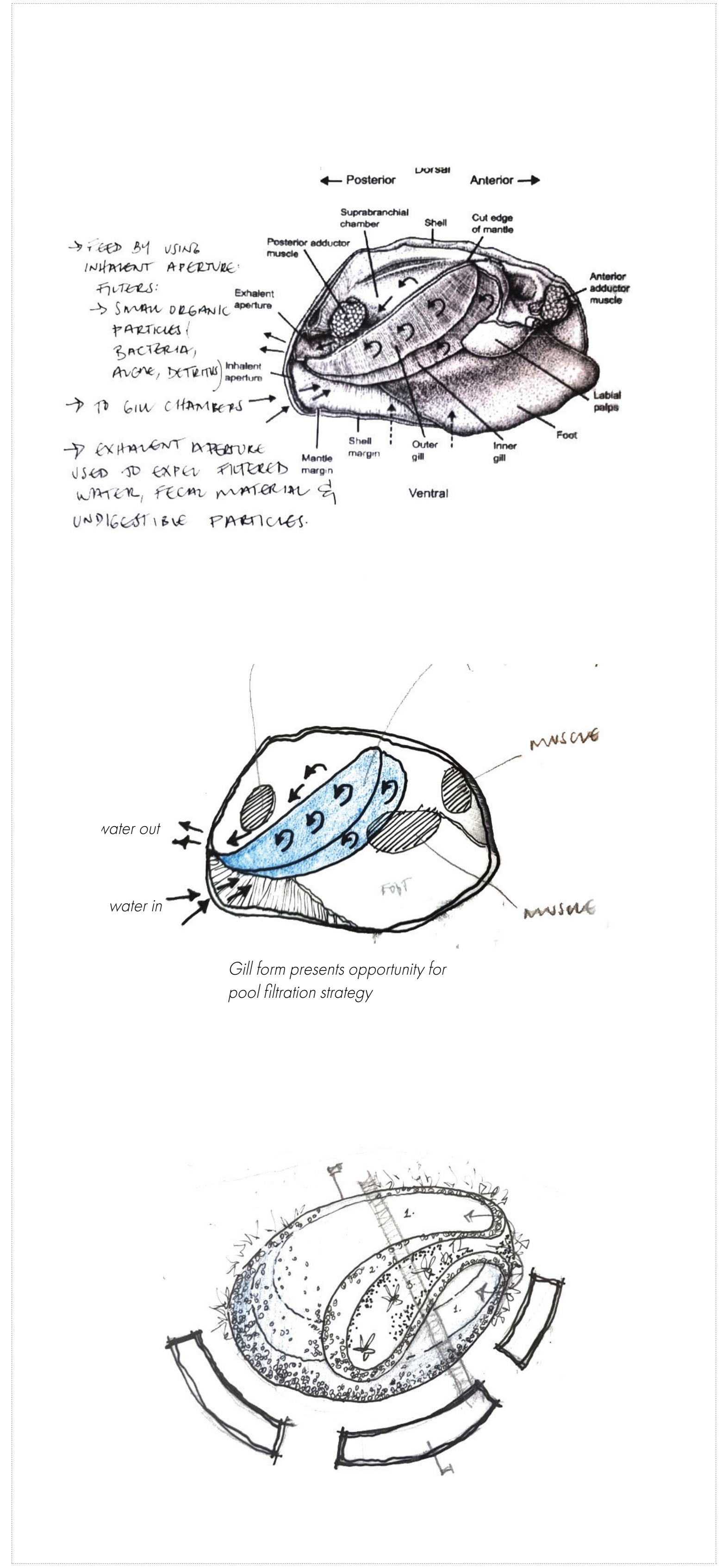
1. To enhance the relationship between humans, biodiversity and water, and,
2. To achieve this in a way that is regenerative for all parties involved.

From these objectives the following brief emerged:

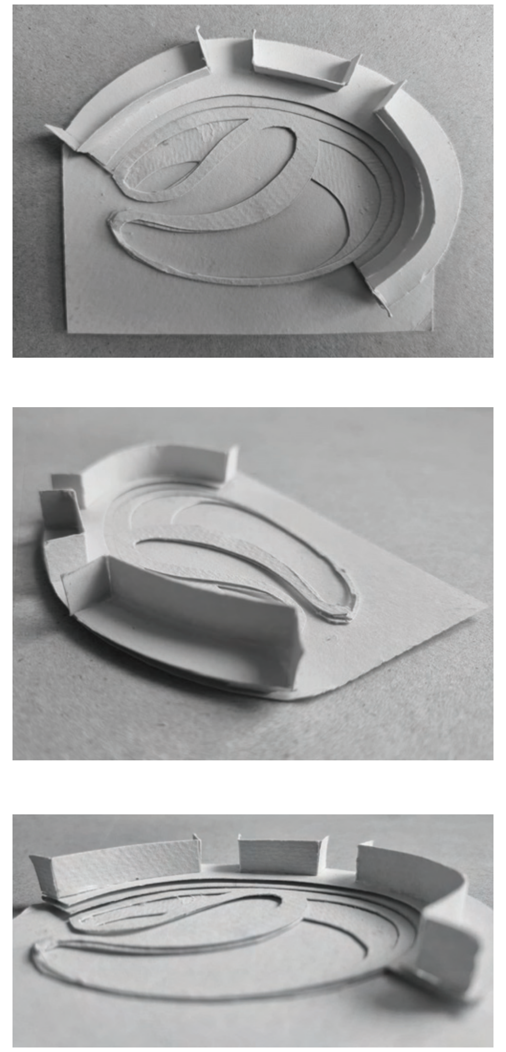
1. Education, through teaching, research and monitoring of incoming water processes, these would be manifested through school programs and visits
2. Recreation, through swimming, promenading and contemplation
3. Habitat creation
4. Good water quality and management



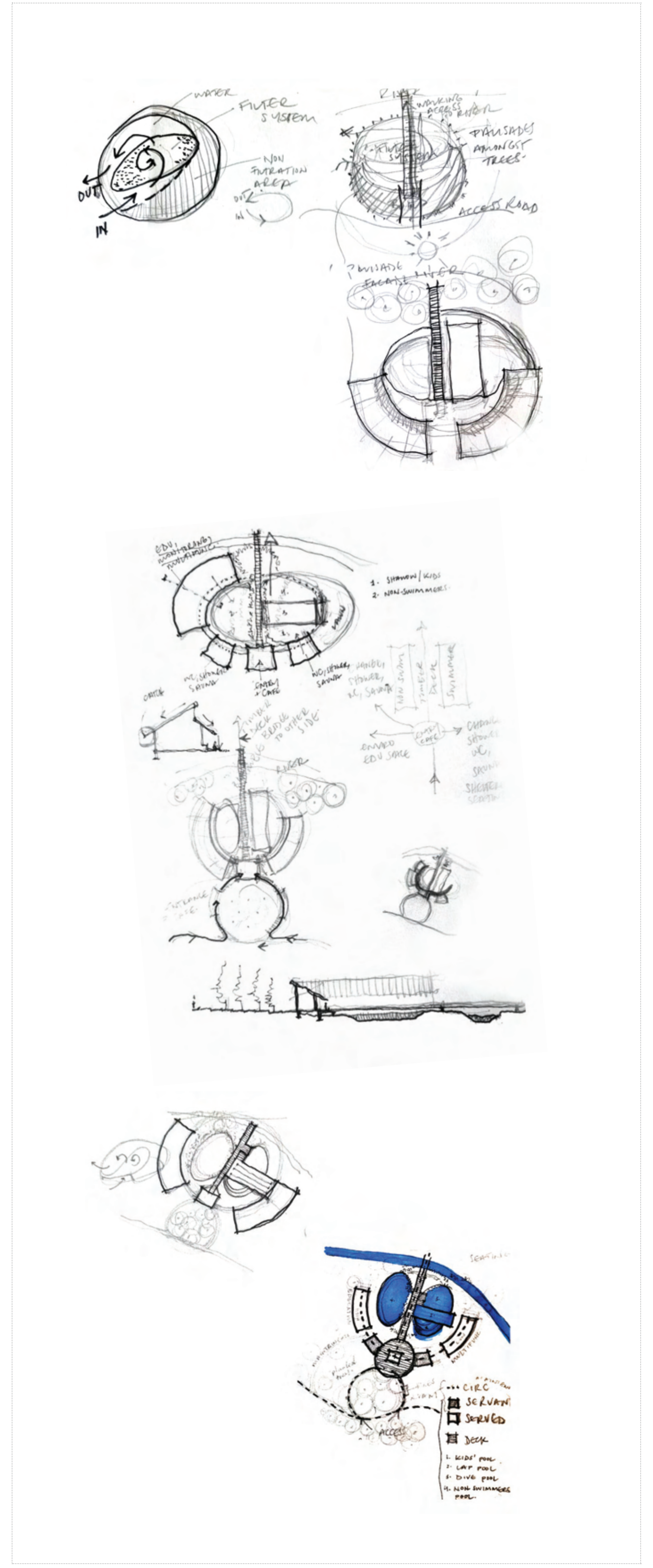
[fig 48] Proposed water flow strategic diagram



[fig 49] Fresh water mussel anatomy inspired early iteration of building and pool form in plan.



[fig 50] Sketch model of previous iterative sketch

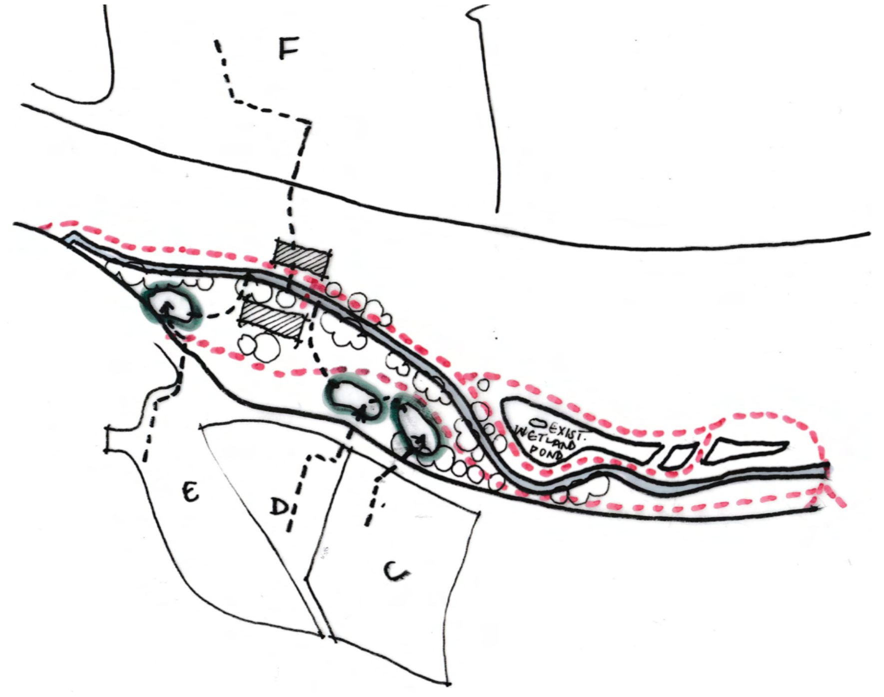


[fig 51] Iterative sketch process

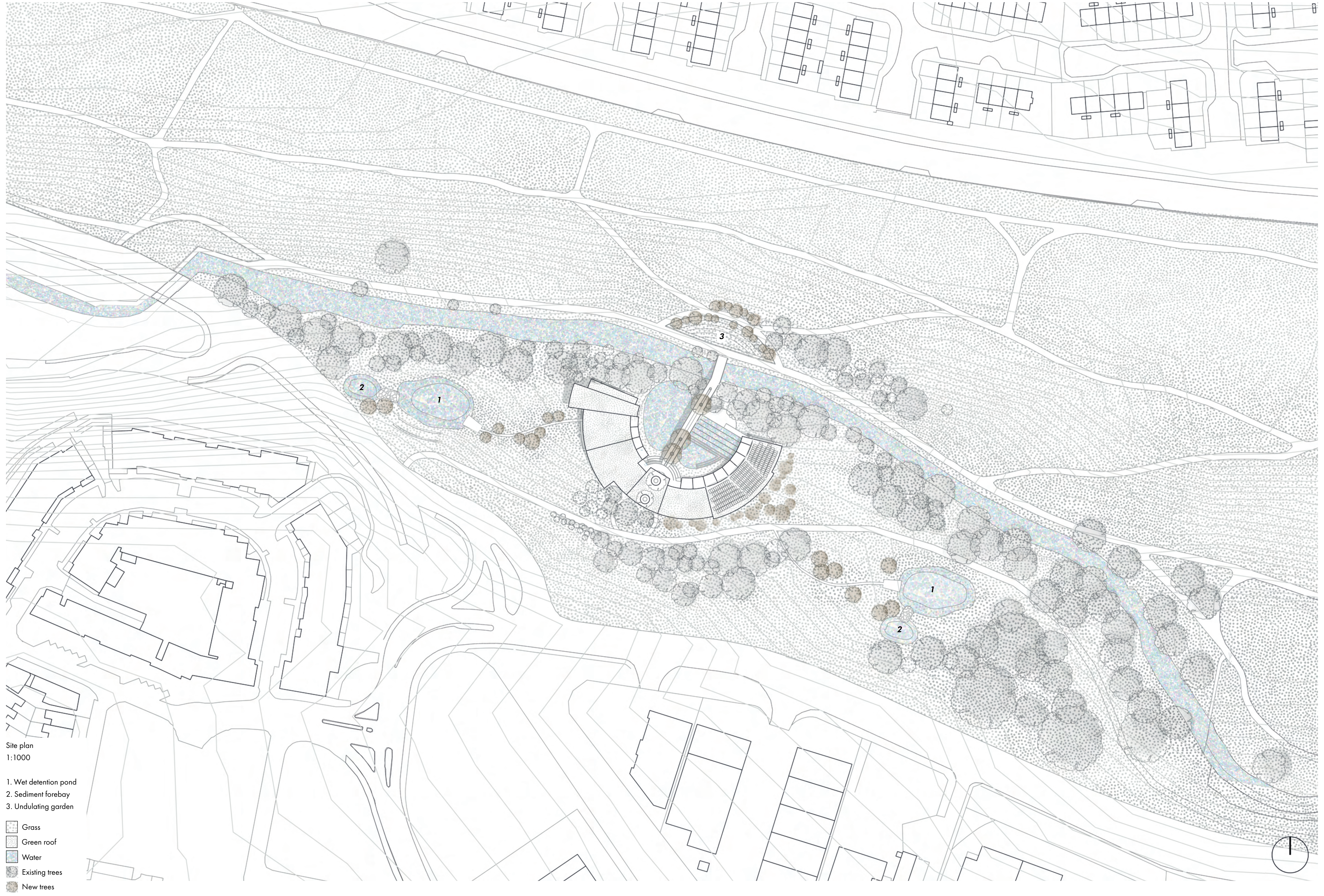
PROJECT & DESIGN: INITIAL DESIGN PROCESS

The site masterplan proposal involves intercepting outfalls, C, D, E and F (see figure 25 and 52). The building in the centre would act as a final filtration-intercepting point before release back to the river.

The building form, in plan, in its early stages was inspired by the shape and anatomy of a fresh water mussel. The gill in the centre, the main filtration structure, was adapted in design and iterated. Essentially, water will go in one way, is filtered through its long "gill" and out again. The symmetry in plan was inspired by the Baths at Caracalla with clear zones to be established.



[fig 52] Early sketch of site strategy



[fig 53] Masterplan

PROJECT & DESIGN: BUILDING DESIGN

Masterplan (figure 53)

The project's masterplan consists of two wet detention ponds with bird observation blinds and the main building with its bridge leading to an undulating water treatment garden. Since the existing site is a wildflower meadow, care was taken to maintain this by elevating the building as much as possible, incorporating green roofs, maintaining existing trees and adding complimentary native trees, (highlighted in sepia) as necessary.

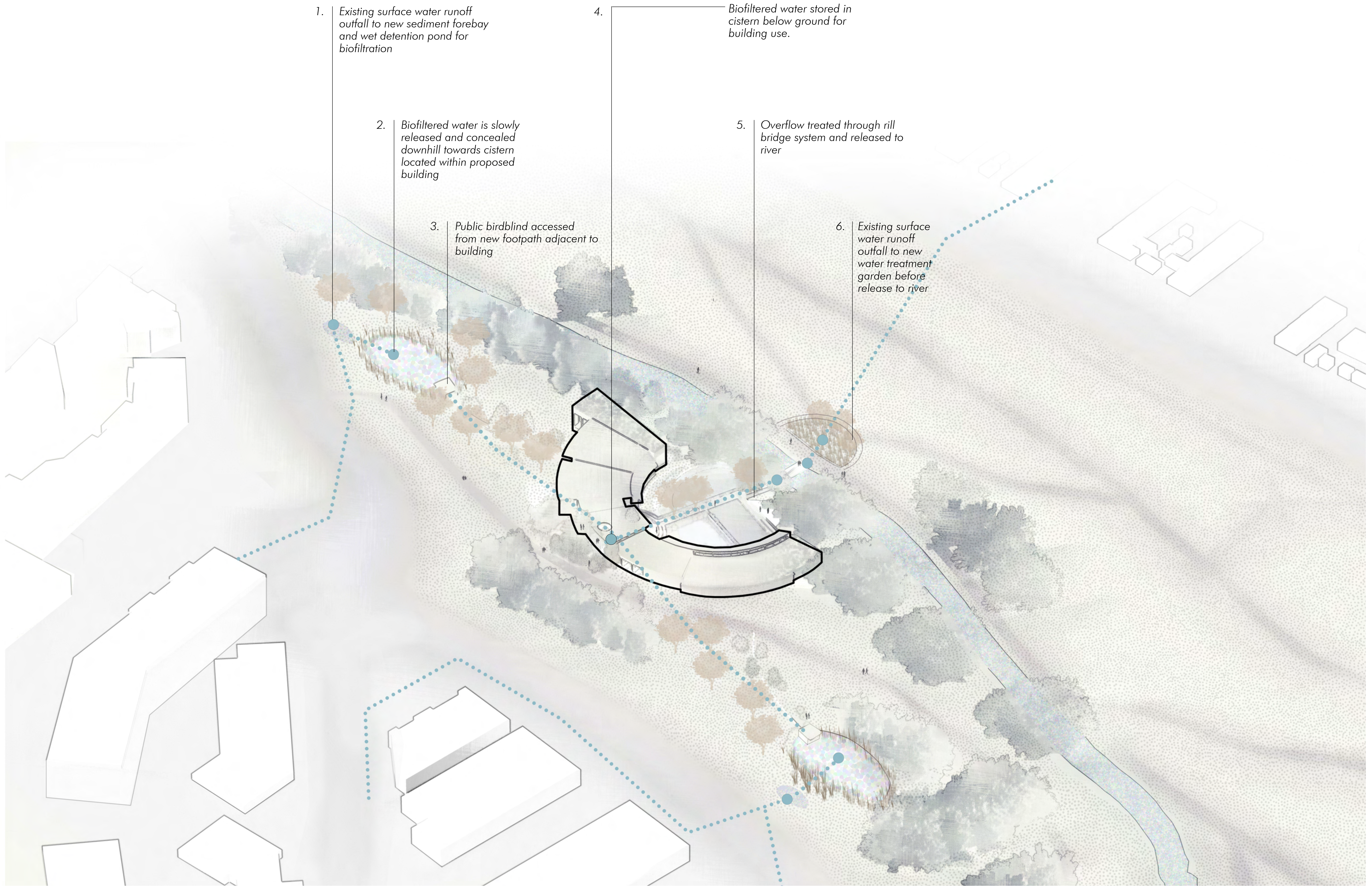
Ground floor plan (figure 56)

Main access into the building is from the existing southern footpath through existing trees and proposed coppice site and down the bending slope towards an open air entrance point with information boards and a water feature ottoman cistern.

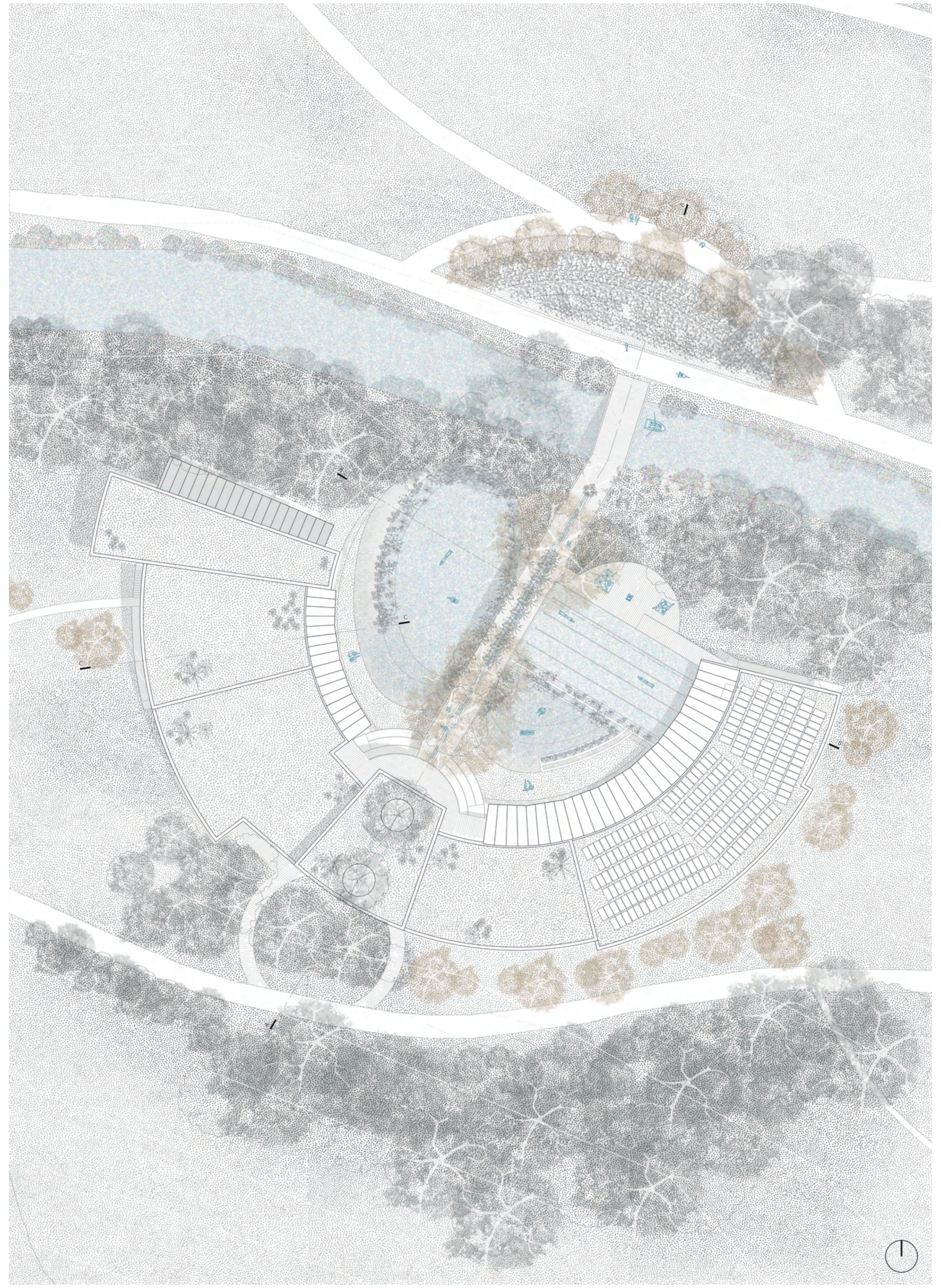
Access to the ecological laboratory is to the left. One enters through a break area with a kitchen, as well as staff and student/visitor bathrooms. There is an outdoor viewing deck with a waiting area and path to the pond outside the teaching laboratory which accommodates 36 to 54 students. There are storage and plant rooms, and an accompanying library for public or scheduled school program use in relation to ecology. Just outside is a viewing deck to the river amongst the trees.

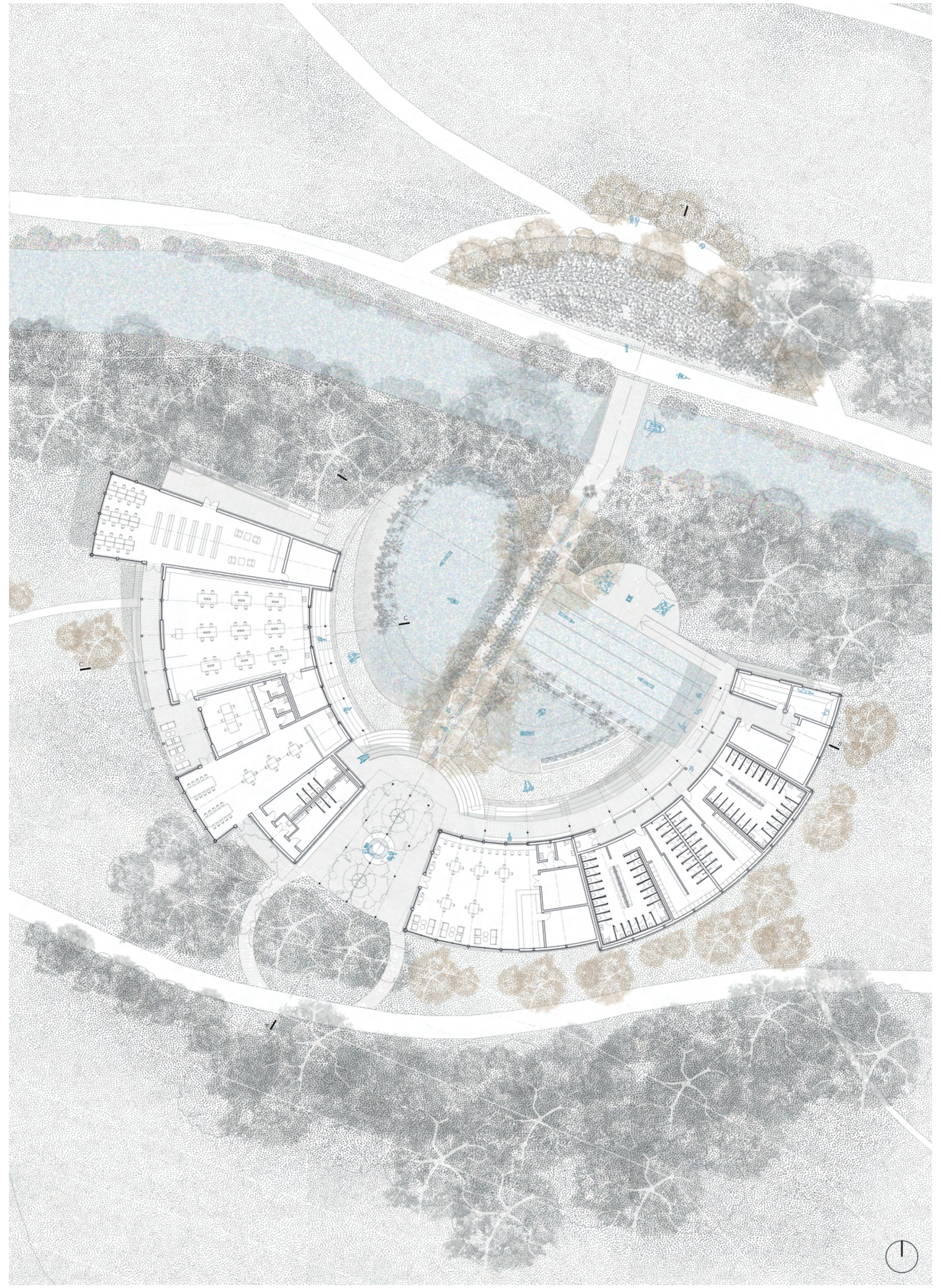
To the right of the entrance way is the community café for gathering, study or relaxation. Around the path to the farther left is a full pool facility with toilets, changing area, showers, a safety room, coppiced-wood saunas and a heat pump room.

The interior spaces are radially flanked by amphitheatre styled seating for viewing and or contemplation. The left side for quieter activity and the right for more bustled activity. This is indicated by the placement of the types of natural swimming pools within the scheme, accessed by ramp. The left side is the wading or non-swimmers pool and the right is the kid's or splash pool and 25 by10m lap pool, accessible off the building deck or viewing deck. The rill bridge separates the pools with new ash trees, acting as a demarcation of zones whilst providing a new habitat for insect eating birds.

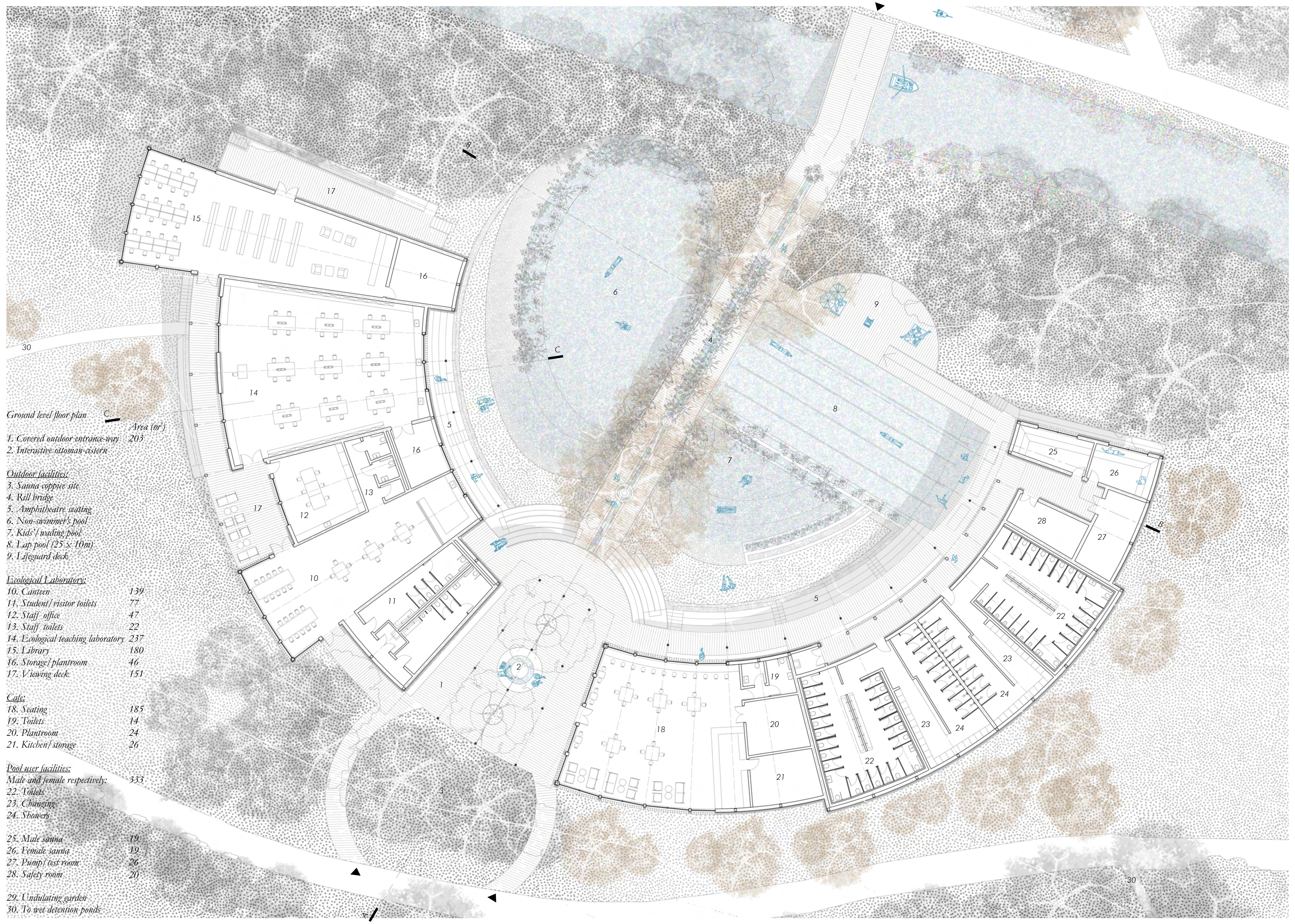


[fig 54] Site strategy

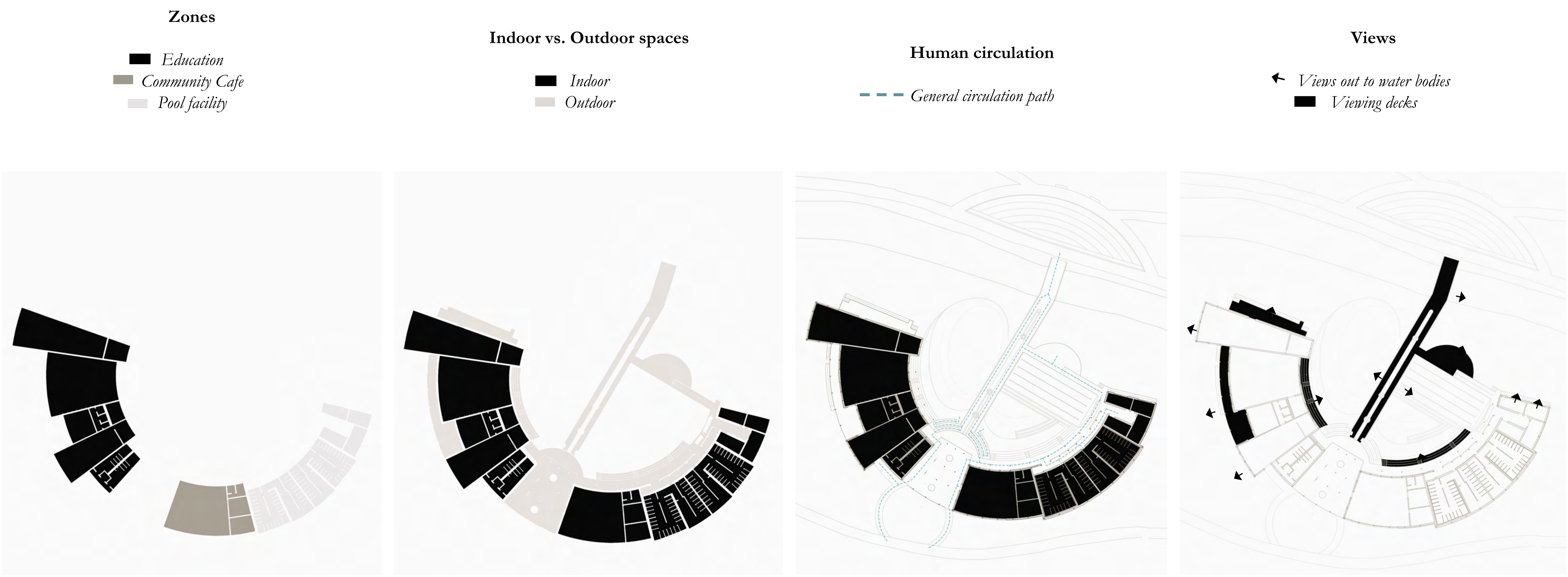




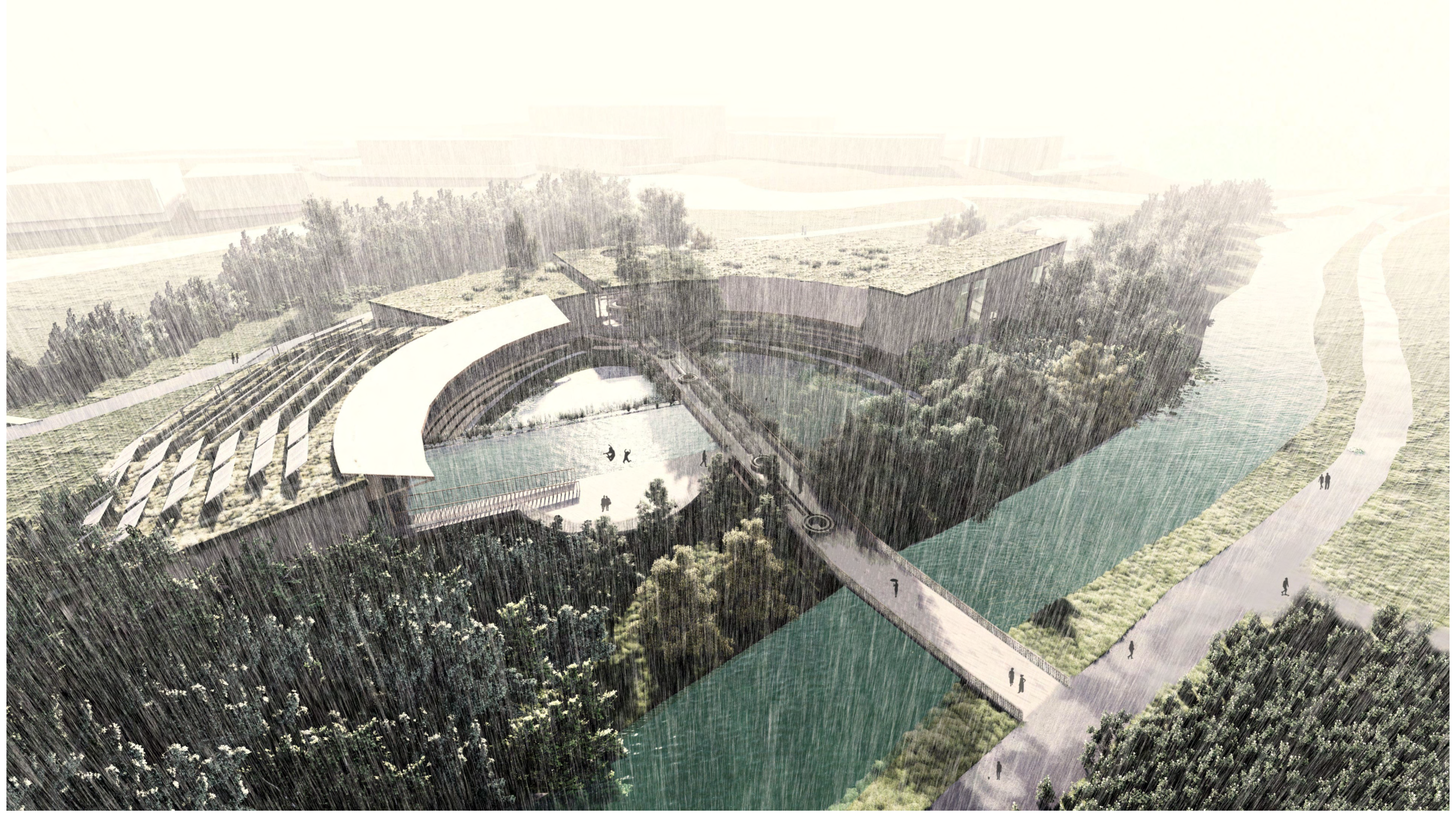
[fig 55] Roof plan (left) Ground floor plan (right)



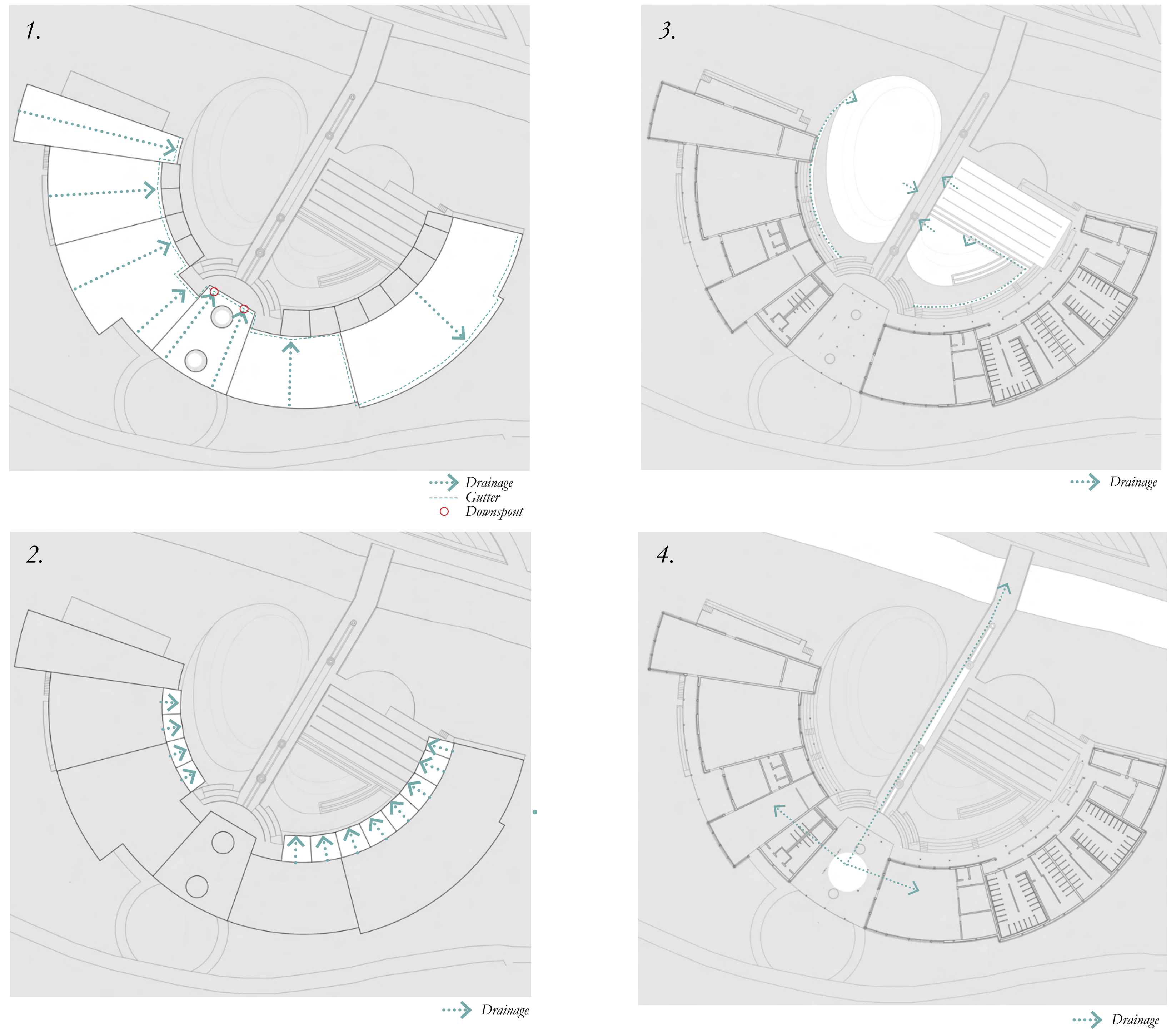
[fig 56] Ground floor plan



[fig 57] Plan diagrams



[fig 58] Exterior aerial view of scheme



[fig 59] Water flow diagrams

The general project water flow is as follows:

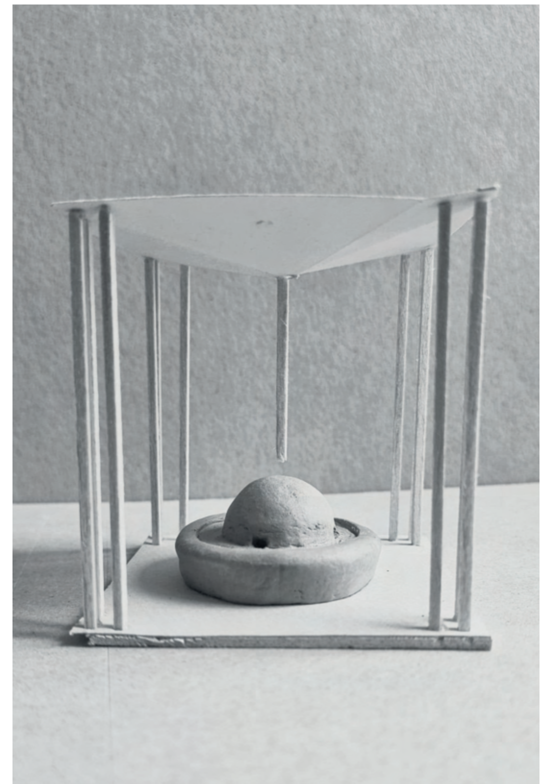
1. Rainwater drains from the main roofs towards gutters and central downspout to the cistern

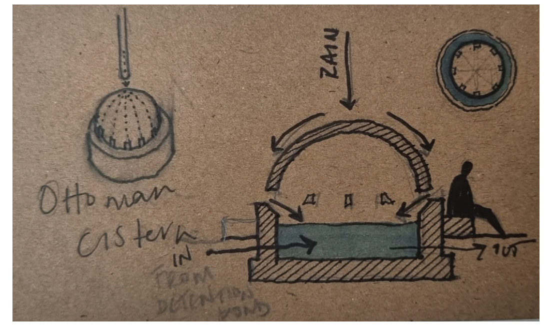
2. Rainwater cascades off the outdoor roof edges to the gravel bed and lap pool below

3. Filtered gravel bed drains towards the pools (initially filled by rainwater) where water is further filtered by plants. The water is pumped and any overflow goes to the rill bridge.

4. Cistern stored water goes to the building for UV filtration and reuse, and overflow goes to the rill bridge treatment system and then released to the river.

[fig 60] Entrance way atmospheric image





[fig 61] Ottoman cistern water feature

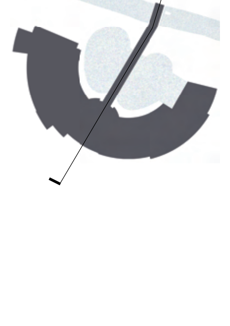
Sense of place

The entrance way is an open-air, sheltered community space intended for gathering, play and learning. It is the threshold before access to different zones. Structure is emphasized by expressions of timber double columns and trusses, reminiscent of the deliberate structural expression of the Caracalla.

Three double columns secure public information boards detailing directions, processes, and habitats. A rainwater cistern sits in the centre with the above section designed as a water collection interactive feature and the below section for storage (see section A-A). It was inspired by Turkish cisterns in the 18th century Ottoman era.

Ottoman era cistern in Turkey

[fig 62] Section A-A



Section A cuts through the centre axis of the scheme and through the rill bridge. Existing birch trees remain and continue to grow through punctures in the blue-green roof. The entrance way sits on the landscape on a raft foundation due to the existing loose alluvium soil.

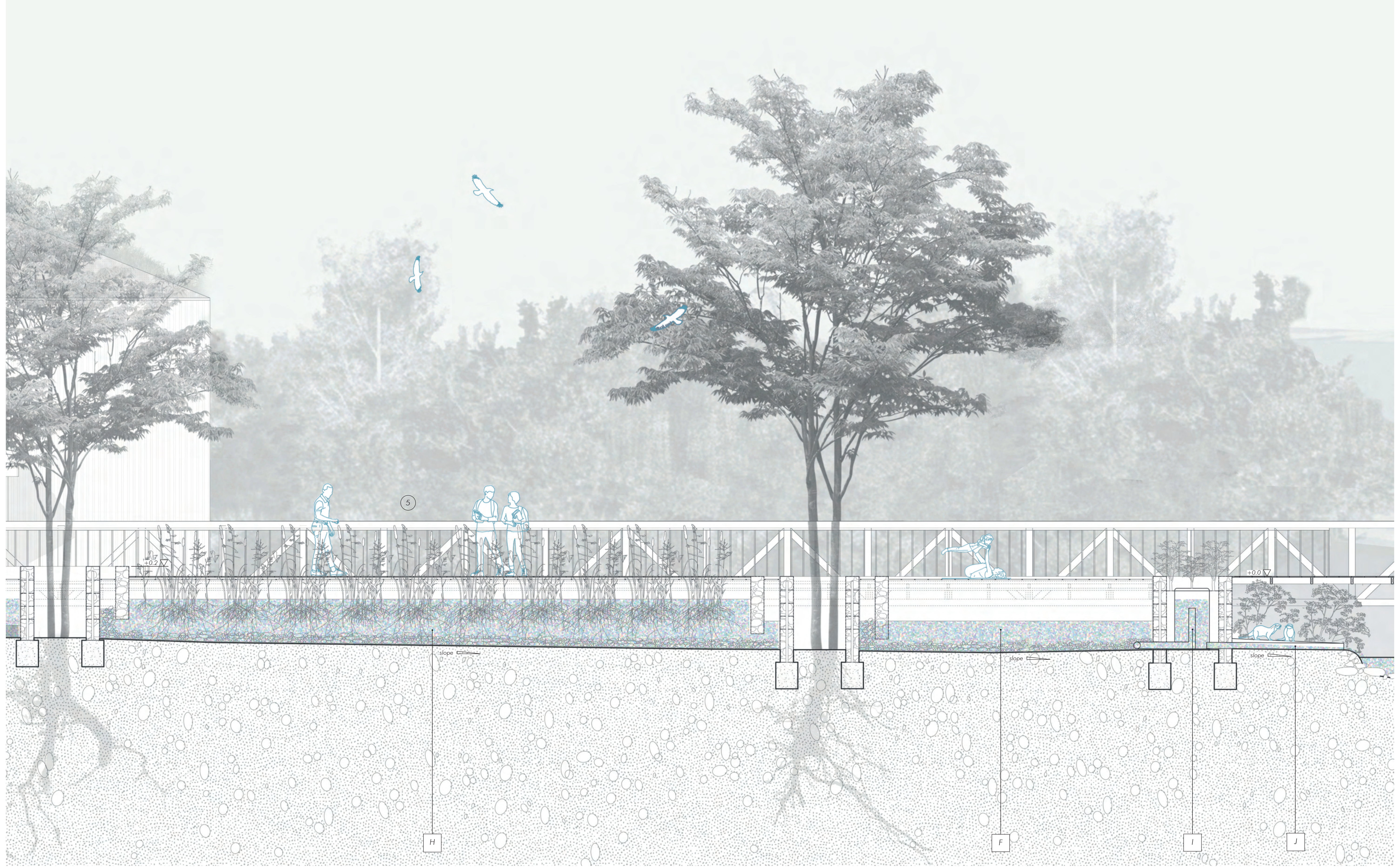
The ottoman cistern is shown. As rain falls, it drains through gutters, falls on to the dome, pools and slowly recedes underground. The structure of the cistern consists of earthbags around the perimeter, which are far more sustainable than concrete walls, and removable if need be. The excavated soil is reused inside the earthbags. The wall is then lined and sealed appropriately. The above section is made of gabion baskets and concrete dome. Water overflow is carried via gravity, down a slight slope towards the rill bridge where water is treated in sections gradually lowered on the existing site slope.

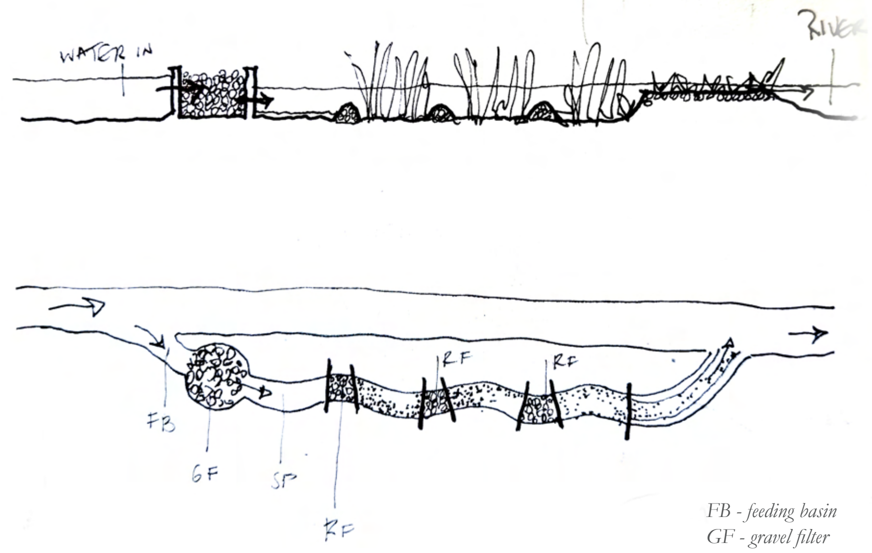
Section A-A (Part 1/3)

LEGEND

1 *Existing pathway*
2 *Entrance to laboratory in background*
3 *Main entrance way with ottoman cistern*
4 *Amphitheatre seating in background*

A *Inlet pipe from wet detention pond*
B *Swale*
C *Blue-green roof draining water to cistern*
D *Underground cistern with earthbag wall (storage for building use)*
E *Overflow outlet pipe*
F *Gravel filtration*
G *Sediment pool*





FB - feeding basin
GF - gravel filter
SP - Sediment pool
RF - rock fragments

[fig 63] Water regenerative system - Gravel filtration

The timber girder truss bridge's level is a consistent datum while the rill train, gradually lowers. The structure consists of gabion walls above and below timber decking. It is an adaptation of a gravel filtration system (figure 63). Additionally, rainwater and debris is caught above and flows through the timber deck where it is filtered below (see section B).

On the bridge, people can promenade freely whilst seeing the processes for themselves. A gridded cover is placed on top to prevent people from falling in whilst still allowing aquatic plants to grow through. At the end of the rill train, water escapes with better quality than at the start.

Section A-A (Part 2/3)

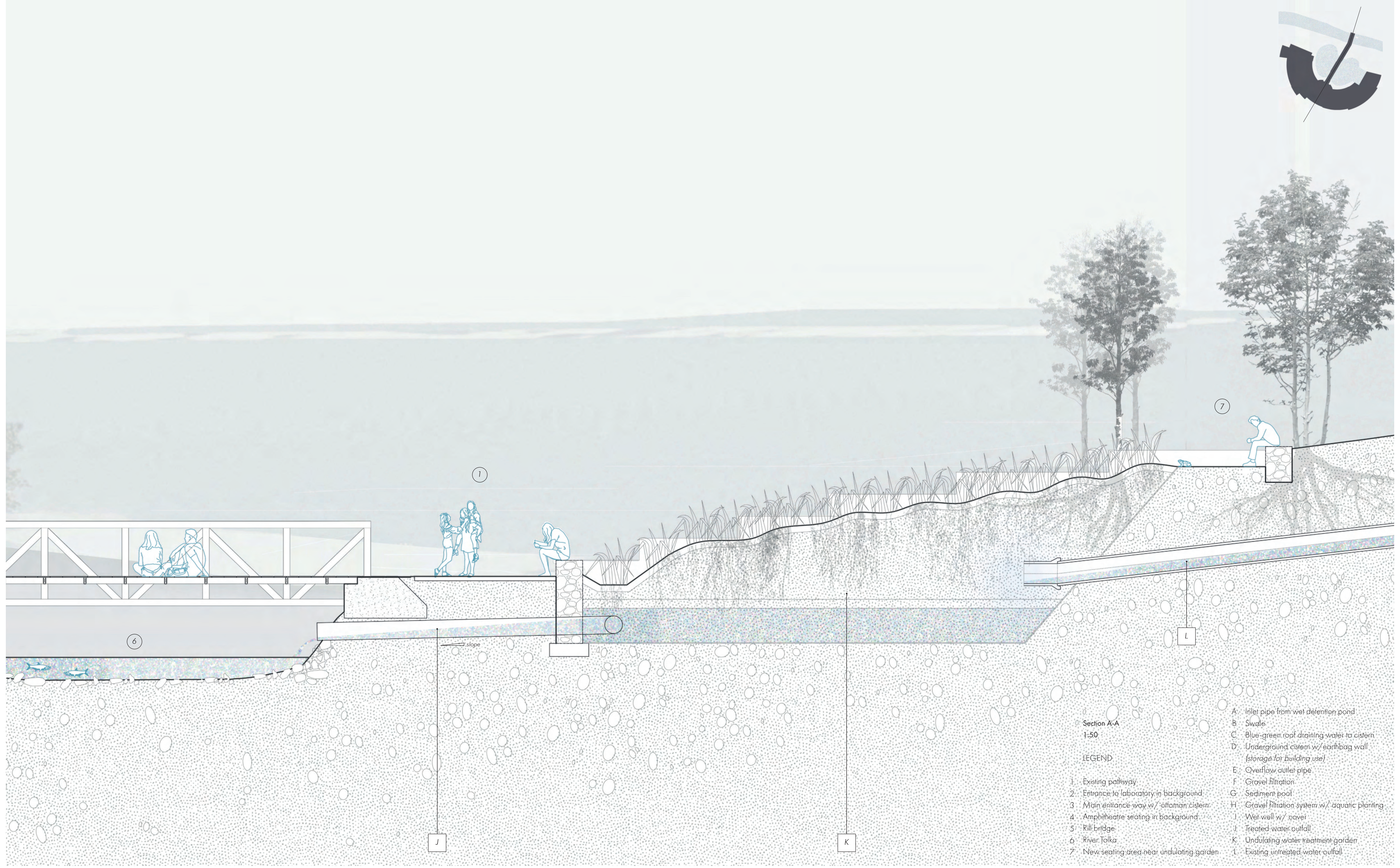
LEGEND

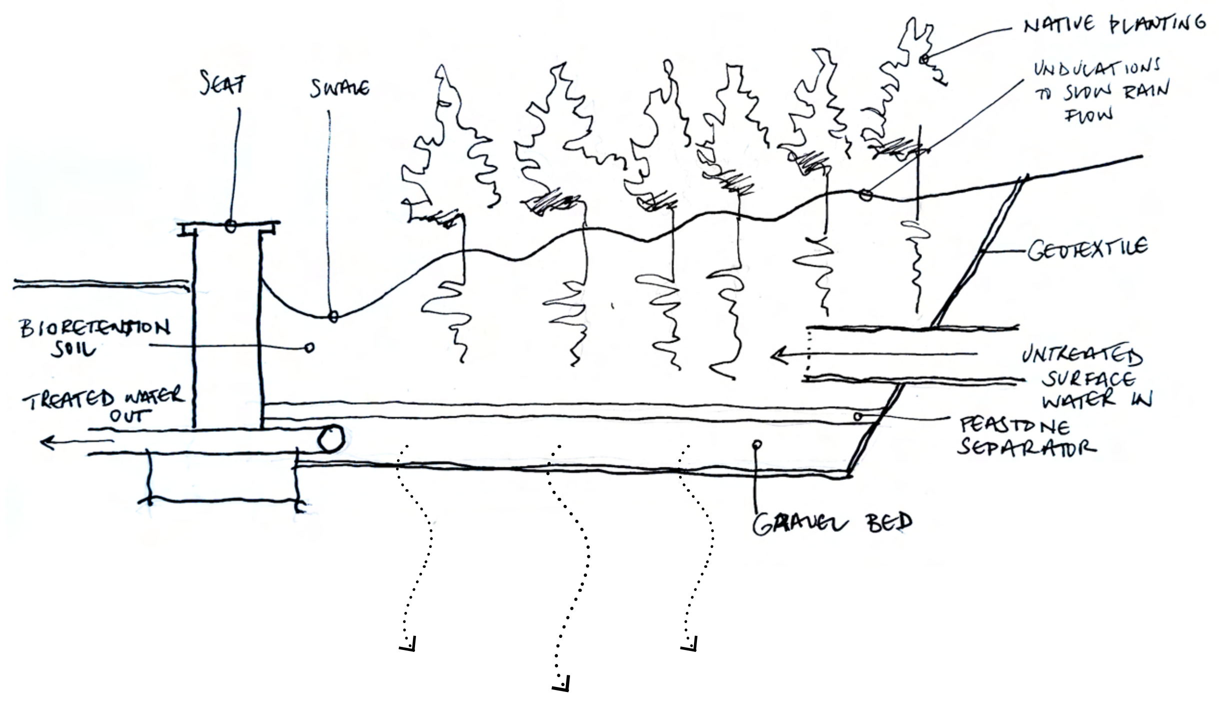
5 *Rill bridge*

H *Gravel filtration system with aquatic planting*

I *Wet well with cover*

J *Treated water outfall*





[fig 64] Water regeneration system - Bioretention soil filtration

Section A-A (Part 3/3)

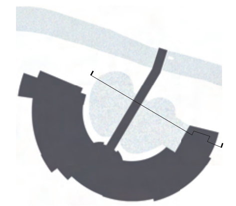
LEGEND
6 *River Tolka*
7 *New seating area near undulating garden*

K *Undulating water treatment garden*
L *Existing untreated water outfall*

The elevated bridge ensures nooks for new sheltered habitats, as well as a boundary between humans above and animals, that naturally prefer to be undisturbed, below.

The end of the bridge leads to footpath north of the river and to the undulating garden with a pathway up to seating. The design is adapted from the basic principles of a rain garden, a small SUDs component meant to act as an infiltration point with native plants (sudsdrain.org). Surface water is intercepted by the undulating garden's bioretention soil where native plant roots take up contaminants. The water slowly falls through a filtering peastone separator, down to a gravel bed and released towards the river, in better quality than it started, and/or assimilated to become ground water. The undulations above slow rain water down in the event of heavy rain. The resulting plantings provide a desirable amenity for leisure activities nearby.

[fig 65] Section B-B

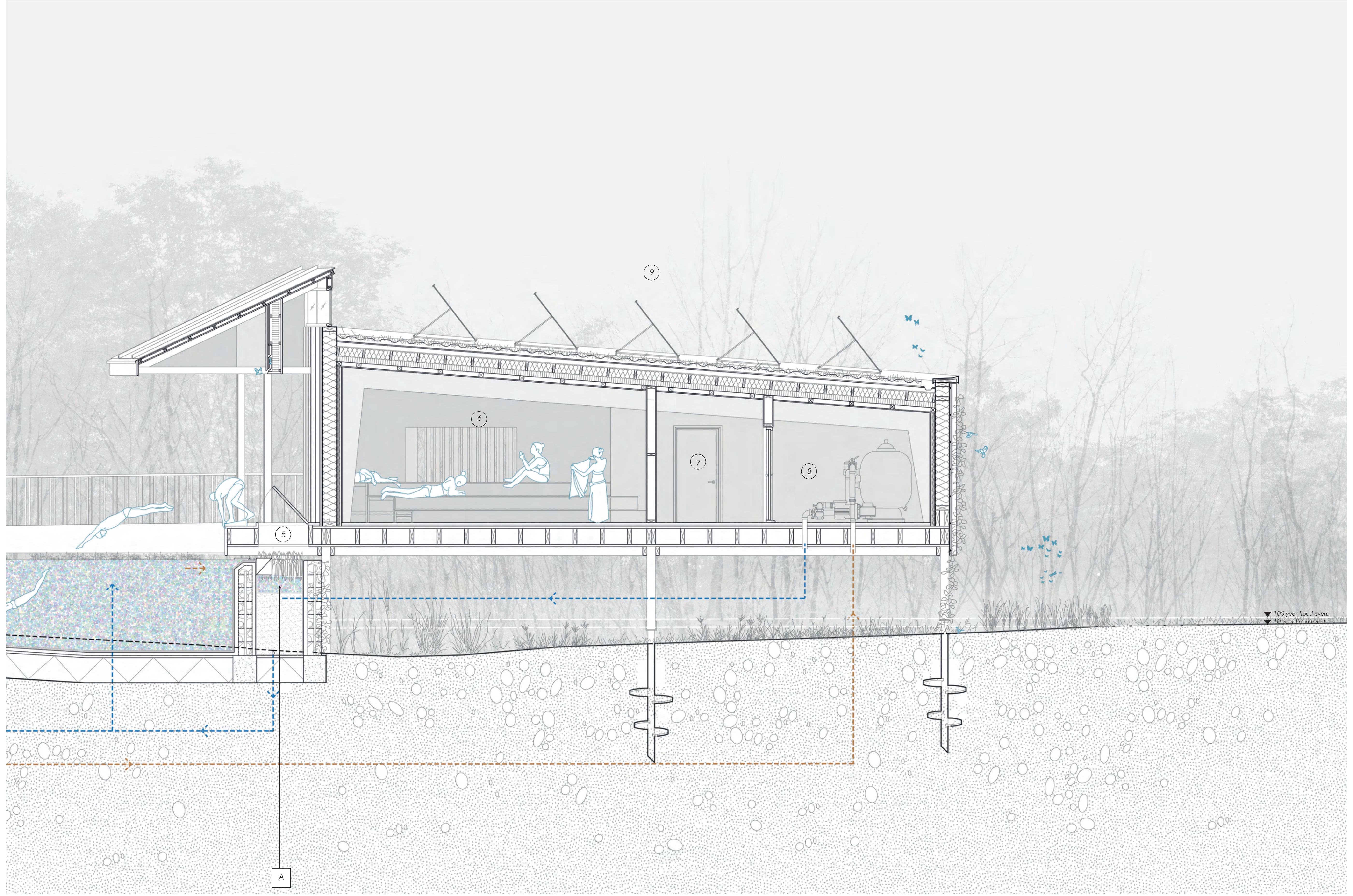


Section B-B (Part 1/2)

LEGEND

1 *Non-swimmer's pool*
2 *Rill bridge*
3 *Life guard deck (in background)*
4 *Lap pool (25 x 10m)*

A *Regeneration pond with aquatic plants (phytoremediation)*
B *Gravel filter*
C *Rill bridge gravel filtration system with aquatic plants (water flow towards river Tolka)*



Section B cuts in the opposite direction through the wading pool, bridge, lap pool and pool facility. The structure stands about 2m at its highest point on timber posts supported by helical piles. This type of foundation is less invasive to soil with alluvium characteristics.

Solar pv panels above provide energy to the entire building, as well as heat to the pump room. This heat sufficiently raises the lap pool water to a comfortable, less frigid temperature. As a rule of thumb, it is recommended that for each square metre of pool surface, one would need one square metre of solar panels (Solar pool supply, n.d.). The roof area provides adequate square metreage for this installation.

The outdoor roof is risen slightly to capture and diffuse south-eastern sunlight, providing a pleasant quality to the space below.

Both pools are surrounded by lined gabion walls. The lap pool base is lined on top of compacted earth and hardcore for a rigid, structure with strict dimensions. The wading pool is less intensive, only lined on top of compacted earth for a more organic look and feel. For the most part, the development occurs above the existing topography indicated in the black dashed line except the wading pool, which is excavated. Both pools are natural, in that it pumps bathed water (in orange) towards aquatic plants which filter through their roots and graveled substrate, then back to the pool as treated (in blue). The diving deck has a service hatch for maintenance purposes. The wading pool is similarly treated with gravel filtration added to the outer perimeter.

Section B-B (Part 2/2)

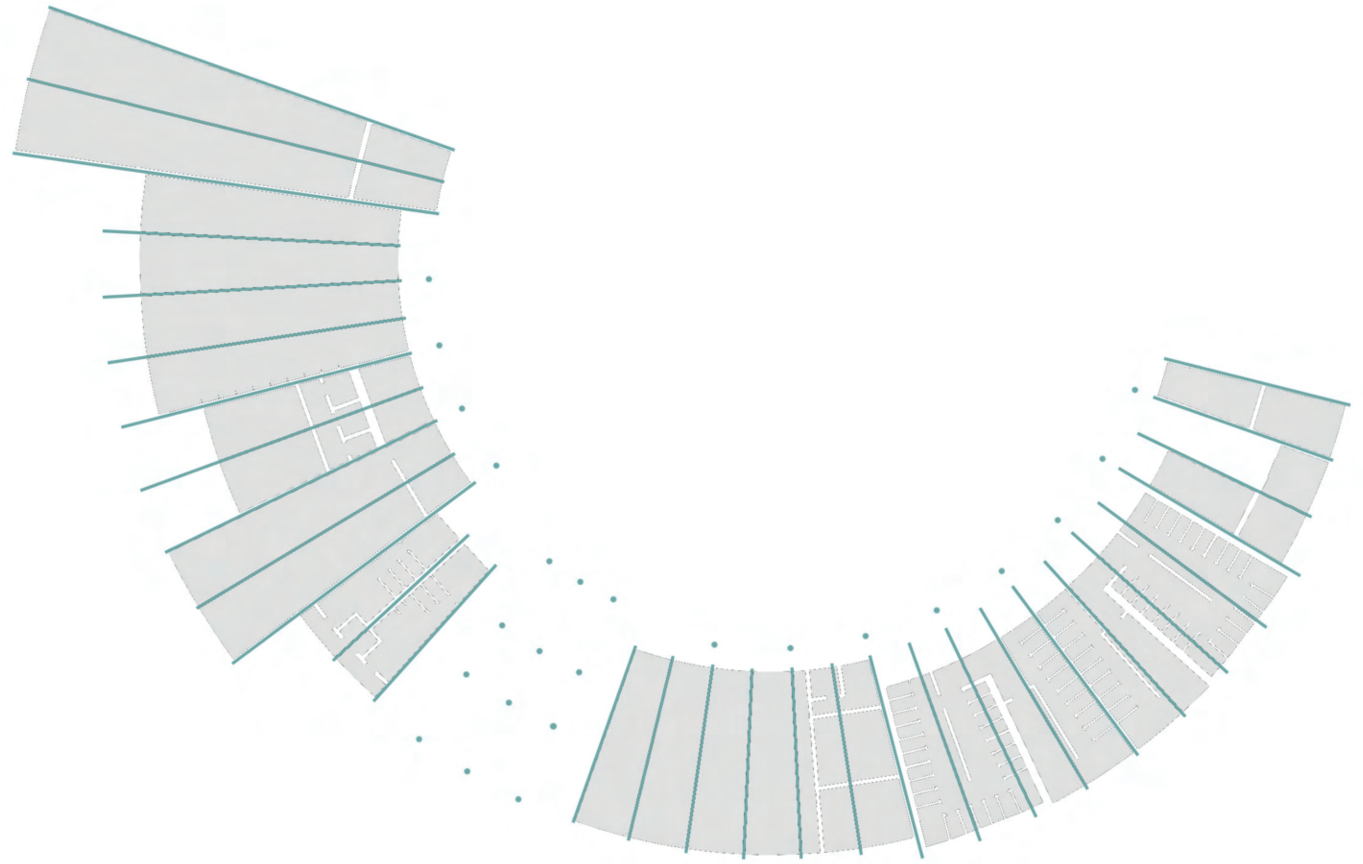
LEGEND

5 *Non-swimmer's pool*
6 *Rill bridge*
7 *Life guard deck (in background)*
8 *Lap pool (25 x 10m)*
9 *Solar PV panels*
(to power building and provide energy for lap pool heat pump system)

A *Regeneration pond with aquatic plants (phytoremediation)*

Bathed water from skimmers
Filtered water
Existing topography line

[fig 66] View to exterior from footpath accessed from Cardiff's Bridge

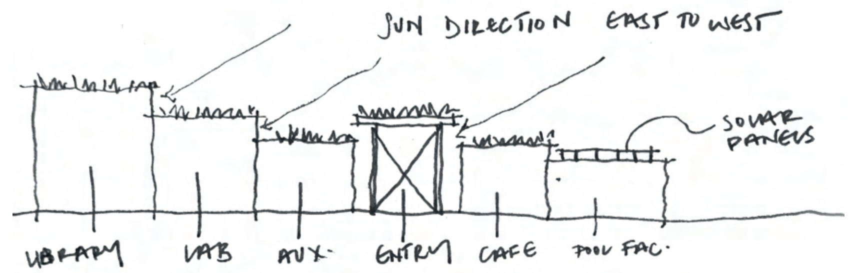


[fig 67] Main structure diagram

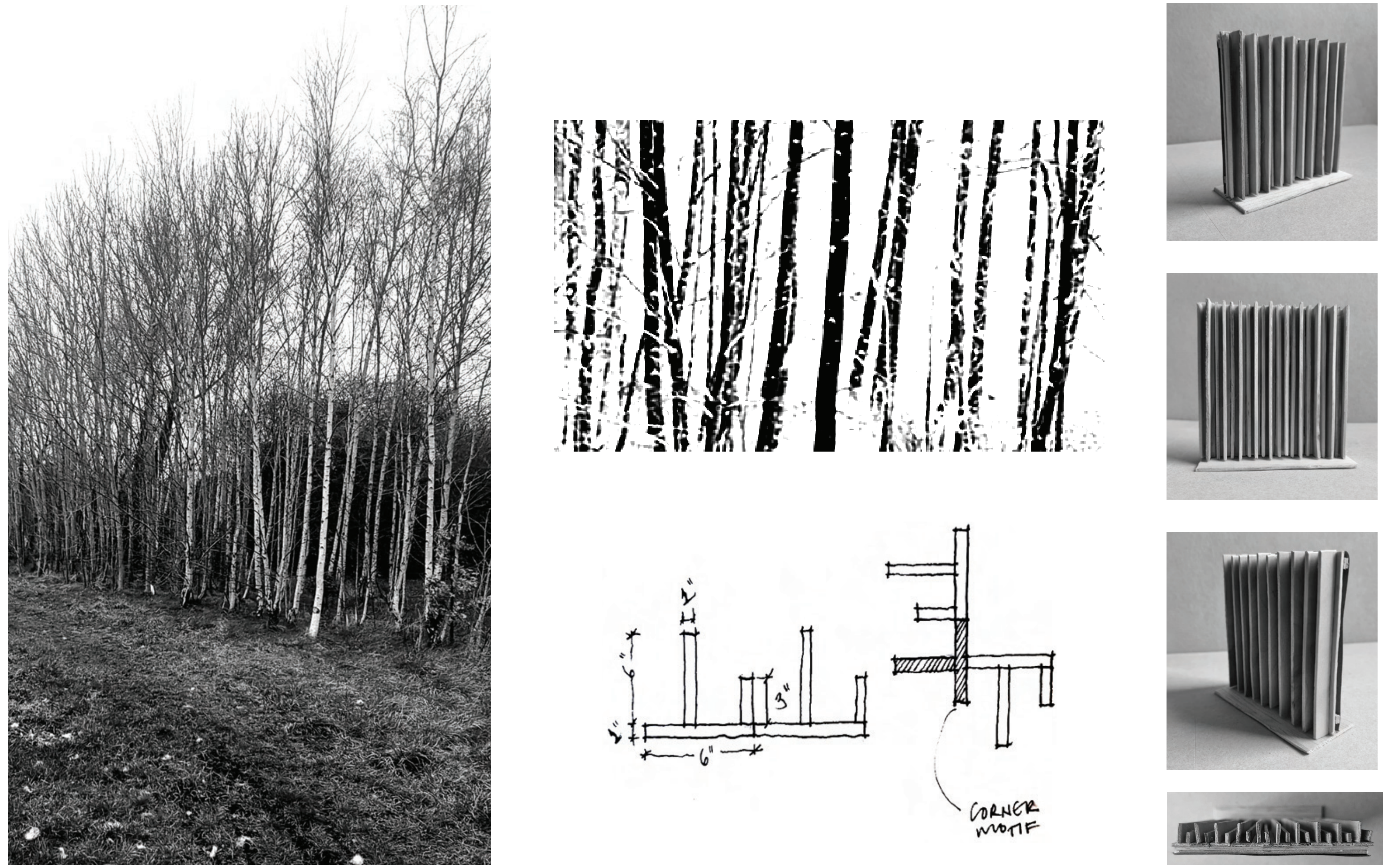
Structure (figure 67)

The building's main structure is laid out on a radial grid and consists of single-slope glulam portal frames (see section B-B, part 2/2 and section C-C), timber trusses in the entrance way (see figure 60 and section A-A, part 1/3), and timber double columns to support outdoor roofs (see figure 60, 70 , 71).

Each roof "segment" has its own height level, except the lab's auxiliary spaces and cafe, which share the same level. These variations in height allow for natural light to penetrate spaces through clerestory windows.



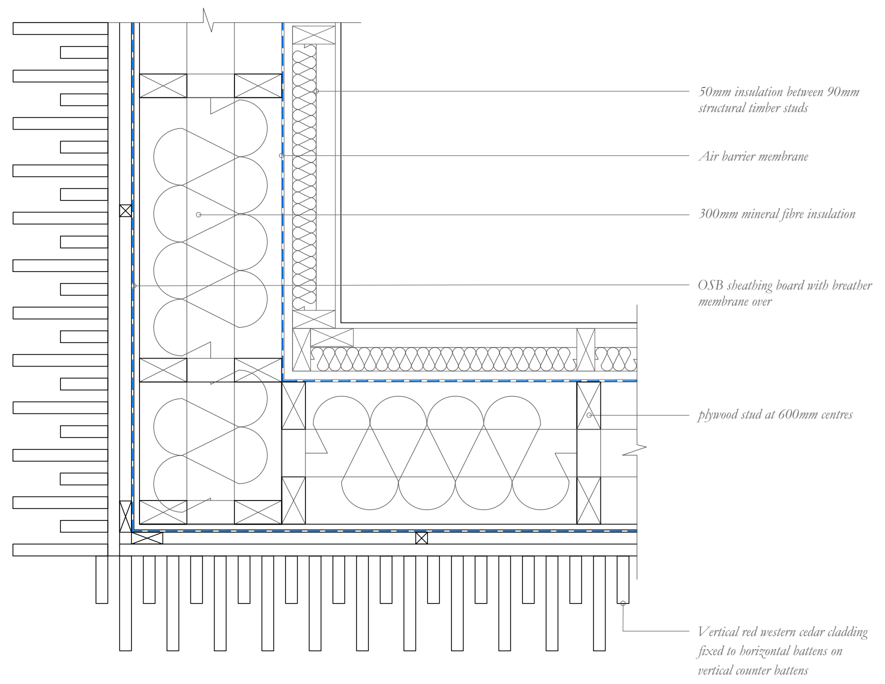
Sketches showing a variation in roof heights



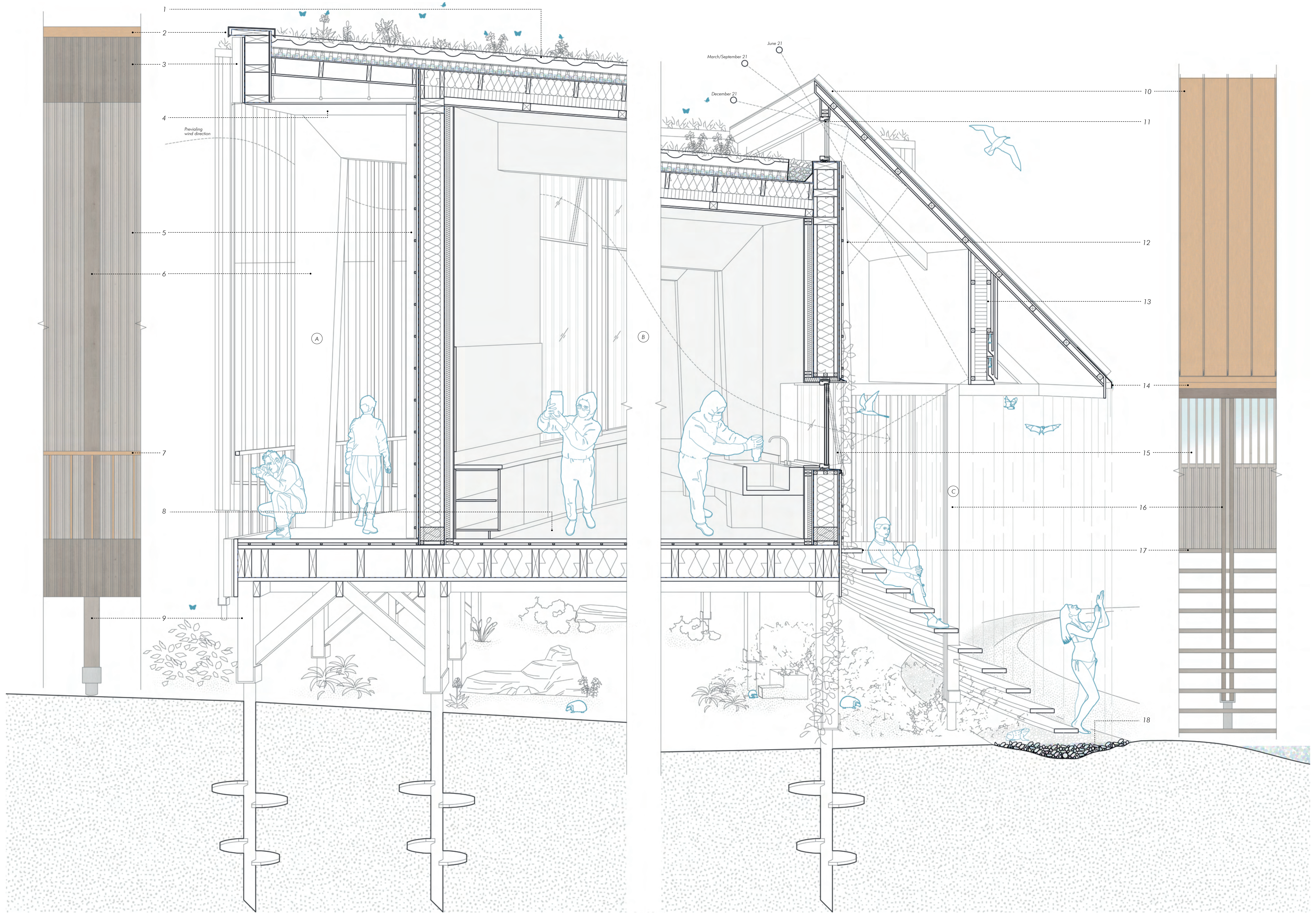
[fig 68] Facade cladding exploration

Facade cladding exploration

The facade cladding was inspired by riverine birch trees. The trunks tend to be slender, narrow and straight with a high canopy. The conceptual intent was to create an aesthetic that encourages touch and blends with the natural environment. It will also provide a surface for native ivy to readily cling to for birds to feed on its seasonal berries (see section C-C). In addition, the arrangements of timber fins in plan and elevation would discourage attempts of graffiti, which is an indicator of anti-social behaviour visible on building surfaces in the area.



Wall build-up in plan with an acceptable U-value of 0.103 W/(m^2K) (Ubakus)



[fig 69] Section C-C

Section C-C

LEGEND

A *Viewing deck*
B *Ecological teaching laboratory*
C *Amphitheatre seating*

1 *Planting, on substrate, on filter layer on water attenuation layer, waterproof bitumen, on OSB 22mm, on timber frame 100x200 mm and rockwool 200mm, 0n rigid insulation 120mm, on technical lathing, on timber sheet ceiling*

2 *Copper parapet coping to fall*

3 *Vertical red western cedar plank cladding, 25 x 150, 25 x 75mm fixed to horizontal battens on breather membrane, fixed to timber stud*

4 *Beaded tongue and groove timber sheet on metal hangers*

5 *Vertical red western cedar plank cladding, 25 x 150, 25 x 75mm fixed to horizontal battens and vertical counter battens, on breather membrane, on OSB sheathing board, fixed to timber stud, 300mm mineral fibre insulation, air barrier, vapour membrane OSB sheathing board, 50mm insulation, 12mm plasterboard on service void*

6 *Glulam portal frame, 200 x 250mm, 700mm deep*

7 *Copper piping balustrade*

8 *2omm birch veneer plywood flooring, on floor battens with voids for heat pipes, on 20mm plywood, on floor joists with fill insulation, on 20mm plywood, on floor joists*

9 *200 x 200mm timber posts supported on helical piles*

10 *Copper standing seam sheeting*

11 *Timber fixed frame window*

12 *Tapered vertical red western cedar plank cladding, 25 x 150, 25 x 75mm fixed to horizontal battens and vertical counter battens, on breather membrane, on OSB sheathing board, fixed to timber stud, 300mm mineral fibre insulation, air barrier, OSB sheathing board, 50mm insulation, 12mm plasterboard on service void*

13 *Timber stud wall with insulation with spaces for daubenton's bats*

14 *Bespoke angled copper profile for vertical water fall*

15 *Timber framed triple glazed awning window*

16 *150 x 150 mm timber double column*

17 *Red western cedar stepped seating*

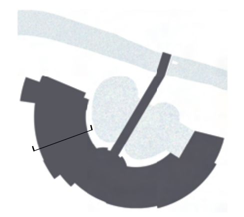
18 *Gravel filter swale*

Social relations - symbiosis through the framework of regeneration

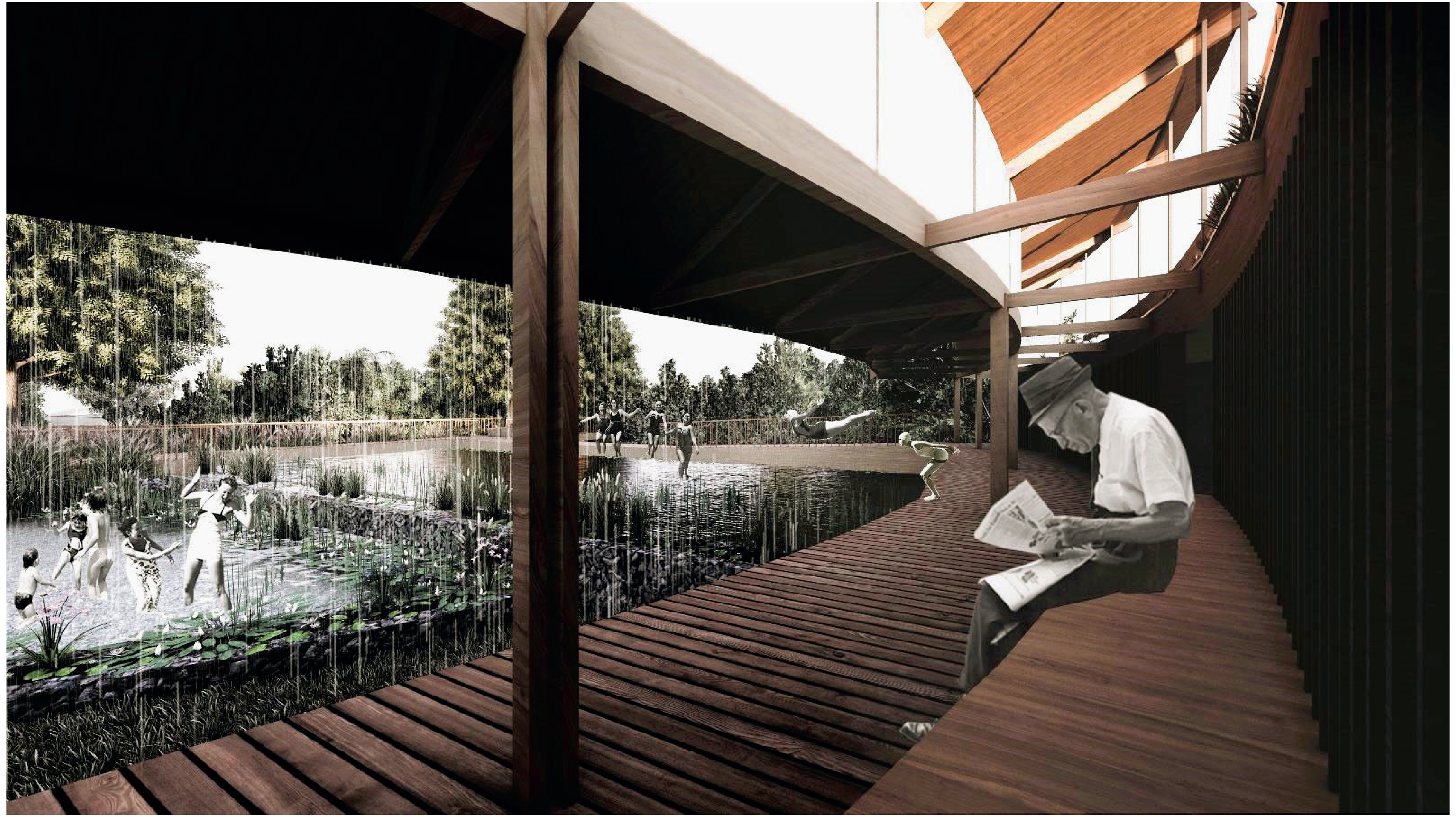
Section C cuts through the laboratory and amphitheatre seating to show construction, materiality, occupancy and a relationship with the landscape, water's drainage, flora and fauna.

The building envelope is mainly of timber and insulated with mineral wool. The green roof provides a new 'meadow' to replace the ground covered by the building's footprint. The cellar provides a mostly dry leafy habitat for animals like hedgehogs, and the alcove within the outdoor roof provides a suitable condition for nesting daubenton's bats.

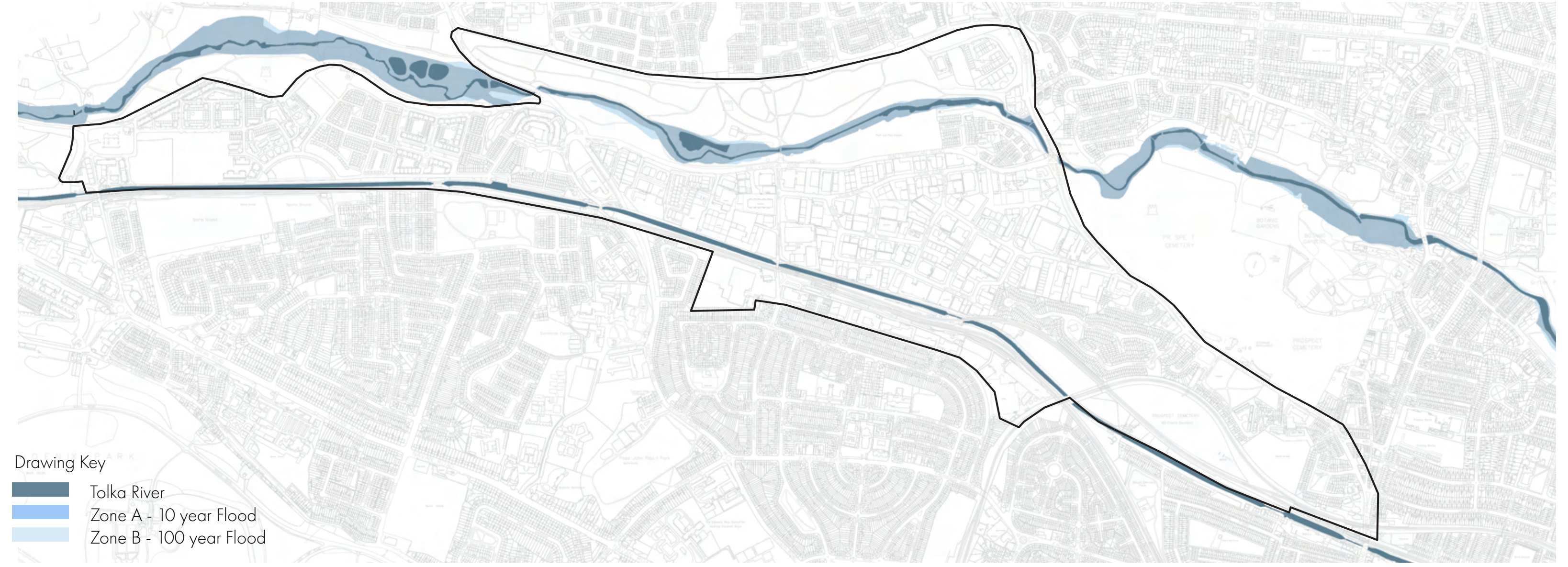
The outdoor roof is sheeted in copper standing seam which is durable and 100% recyclable. It was selected not only for its durability and sustainable properties, but for the delightful sound metal makes when rain drops hit it. The façade cladding consists of durable and visually pleasing red western cedar wood planks. Both materials are readily sourcable within Ireland.



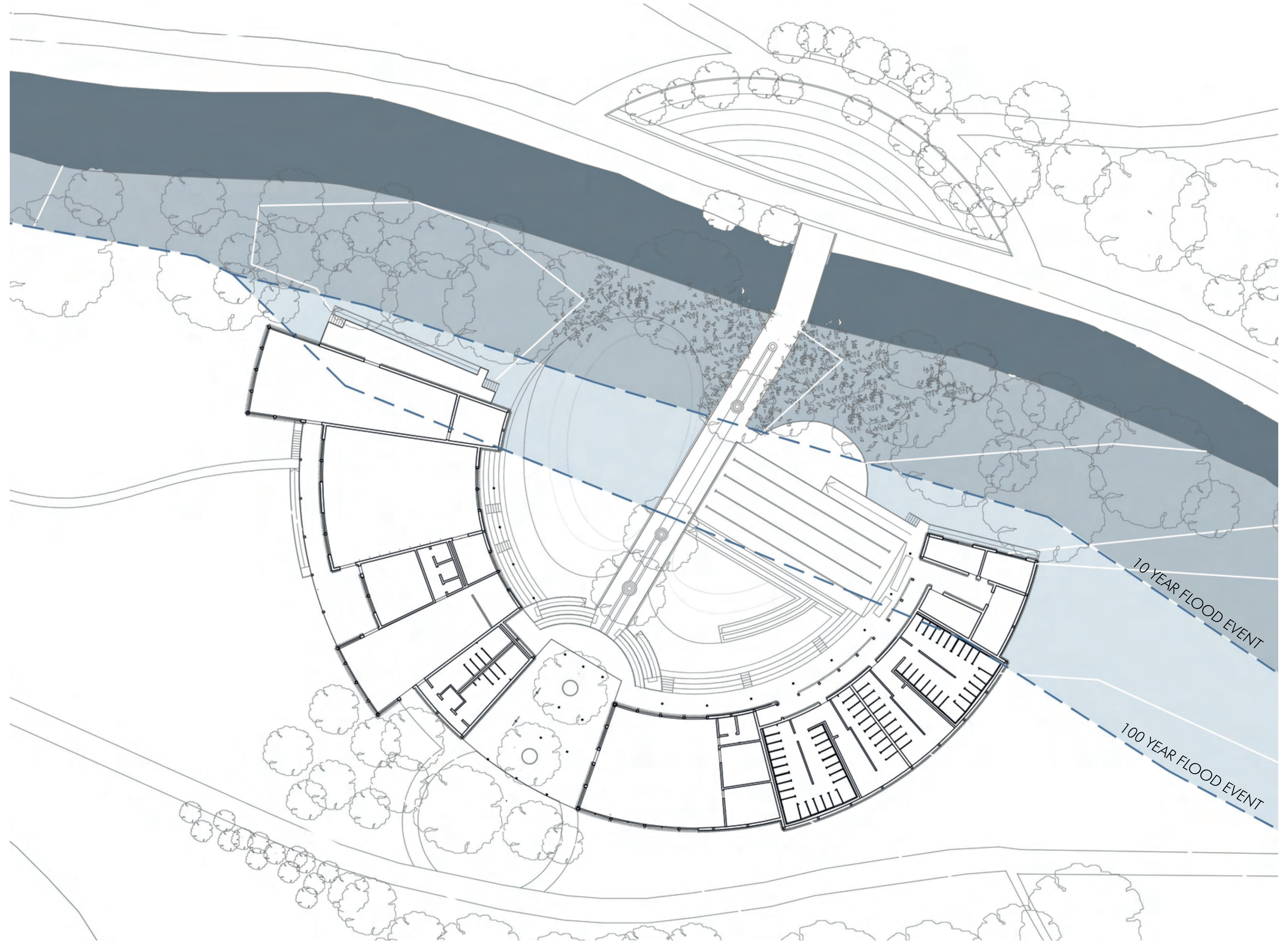
[fig 70] Left wing amphitheatre atmospheric image showing wading pool



[fig 71] Right wing amphitheatre atmospheric image showing splash pool and lap pool



[fig 72] Predicted flood map for River Tolka (Dublin City Development plan 2016-2022 SFRA)



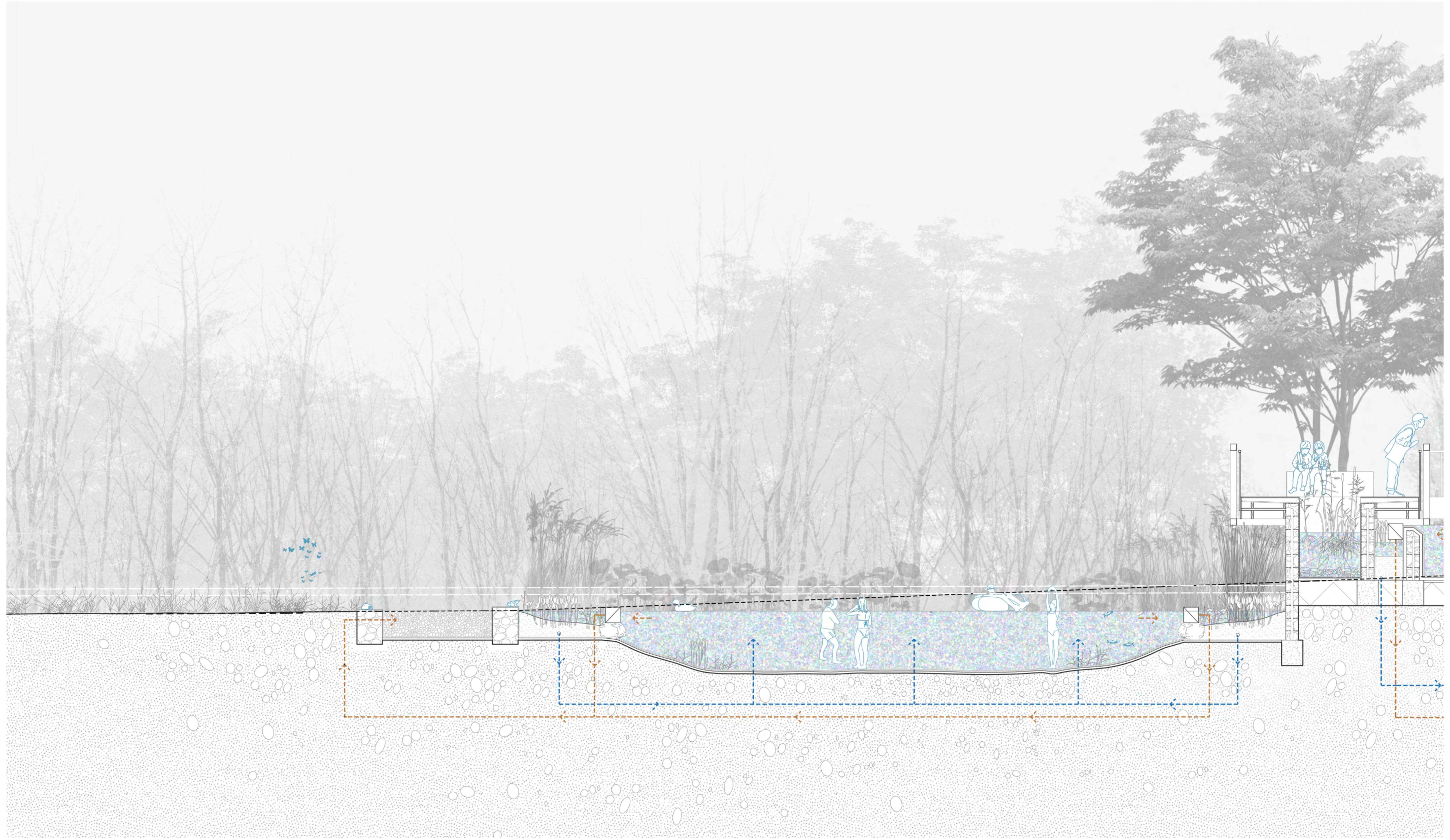
[fig 73] Flood map superimposed on to proposed site

PROJECT & DESIGN: FUTURE-PROOFING

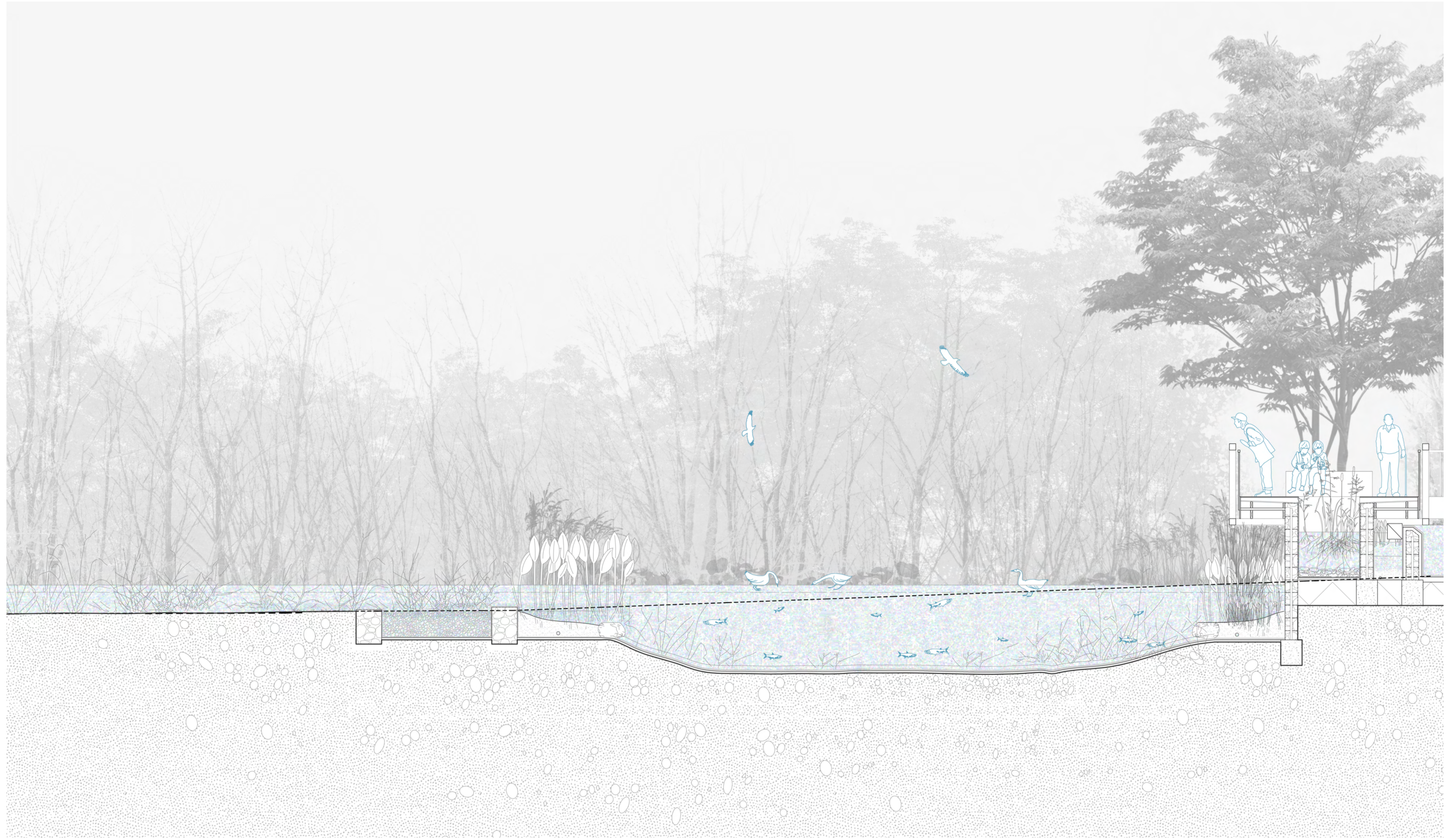
Speculative flood mapping, according to early site analysis, assumes the appearances shown in figures 72 and 73 for a 10 and 100 year event. The building is sited in an appropriate construction zone - 25m offset from the river edge.

In the event of a flood, the building scheme reflects variability and is equipped to let the flood waters pass through. Since the wading pool is the lowest level pool without a barrier (as oppose to the splash pool) it would be sacrificed and act as a small temporary wetland, bringing the ecological lab closer to the river for further monitoring. A new habitat for wildlife would result.

Since the lap pool and building are elevated by lined gabion walls and helical piles respectively, the other programs will remain functioning. All participants would continue to utilize the facilities and landscape simultaneously.



[fig 74] Section B before flood events



[fig 75] Section B during flood events

[fig 76] Atmospheric image showing left wing pool sacrificed and flooded, right wing pools' functions remain the same

[fig 77] Left wing pool transformed into temporal wetland. Ecological lab brought closer for additional monitoring opportunities.

4 REFLECTIONS & CONCLUSION

REFLECTIONS & CONCLUSION

Stage 4 Interim Review - 24/02/2023

A desk study of the site was carried out leading to the interim review. The challenges of the site were established and further research into appropriate means of interception and water treatment were also carried out. A few strategic sketches emerged but suitable precedents and typology, to carry out the objectives, were not convincing enough yet. In early site strategy sketches, an architecture was to manifest itself on both sides of the river, with a pool each to potentially assist in filtering the surface water before release to the Tolka (see figure 52).

Reflections, based on comments from the interim, were summarized as follows:

1. The justification for two pools needed to be convincing.
2. The water element of the project needed to be represented well and celebrated.
3. There was little interest shown in the technical data shared regarding rainfall volumes, surface runoff rates and the sizes of SUDs components needed to accommodate it. The technical aspects of water filtration were emphasized too much as oppose to the architectural qualities that the project could potentially possess. Focus should be placed on what connects people to existing waterbodies.
4. The relationship between the landscape and infrastructure as an amenity needed to be explored.

Stage 4 Final Review - 31/03/2023

In the days leading up to final review a clear concept was established. However, the idea of using swimming pools to filter surface runoff became infeasible due to contamination risks. Though many attempts were made find a solution, it was settled that the natural swimming pools' biofiltration process had to be closed looped. Other ways to incorporate water regenerative strategies into architecture were interrogated. In addition to this, clear zones for users still needed to be progressed. Since the typology included a pool facility, attention needed to be placed on aspects of changing and showering with a realistic number of fixtures, in a sensible location. A general arrangement floor plan and one long section through the centre of the scheme, the kids pool and lap pool, emerged.

Reflections, based on comments from the final, were summarized as follows:

1. Particular emphasis was placed on working out human occupancy but participation, by other actors within the system, needed to be taken in consideration. Non-humans should be given equal attention. Make the site appropriately wild and less manicured.
2. Interaction with the landscape with very little or no concrete use should be explored.
3. Long sections can be used to express a story and depict an understanding of regenerative architecture.
4. Pools should be expressed clearly and celebrated.

5. Due to the orientation of the building, no natural daylight would reach the north-facing outdoor amphitheatre seating area. Attention in this area was required.

Stage 5 Final Review - 12/05/2023

As the final review approached it was maintained that the best way to express my topic was through the use of rendered plan and sections, supplemented by edited 3d renders to express atmosphere and evoke emotion. Hard lines drawings and technical diagrams did not prove to express this enough based on previous tutorials.

Comments from the final are summarized as follows:

1. Future proofing was also a generator of the final proposed architecture. It is important and therefore should be a key part of the objectives presented at the beginning.
2. The technical aspects are far beyond the expertise of Architects. We need to steer away from areas we know nothing about.
3. Do we need to build? The scale of the program has to be necessary. Can spaces be layered on top of one another? Can they be shared? Can some decks be a part of the landscape rather than man-made construction?

The topic 'relationships with water through regenerative architecture' lead me to two main aims:
1. To enhance the relationship between humans, biodiversity, and water, and,
2. to achieve this is in a way that is regenerative for all parties involved.

Human experiences with water manifested themselves in physical spaces where the following themes of focus emerged:

1. Sense of place, other wise known as place identity, the spirit of a place or a sense of belonging,
2. Aesthetic values, personal to an individual, involving the exploration of the nature of beauty through our senses and emotions,
3. Social relations, referring to the involvement of natural spaces with the daily routines of residents to use, enjoy and build strong community bonds.

Regenerative design is defined as a system of technologies and techniques that is intended to renew rather than deplete underlying life support systems and resources within socio-ecological wholes.

Regenerative architecture, by extension is the practice of engaging the natural world as the medium for and generator of architecture.

Systems of regenerative techniques involve an understanding of the natural processes of water. These include:
1. the hydrological cycle,
2. with focus on biofiltration through phytoremediation and filter feeders

These natural processes inspire and were manifested in technologies such as:
1. Integrated constructed wetlands,
2. Wet detention ponds,
3. Bioretention garden,
4. Blue-green roofs,
5. Swales,
6. Cistern storage,
7. Natural swimming pools

Through the responsible selection of materials and structure, such as timber, gabions, earthbags and helical piles, a variation of conditions were created, forming habitats that I believe are fit for a riverine ecosystem's relationship with water.

Given that development implies change to a specific landscape it may evoke a familiar notion that architecture does more harm than good. Early questions, which arose from the thesis topic, were asked. These are: can new-build architecture be appropriate within a natural context? Can it give as much or more than it takes? I believe that the proposed scheme answers these questions and achieves my objectives. The architecture successfully merges the relationships of all parties involved while providing a possible solution for bettering the quality of water outfall to the River Tolka. Though this aspect was a success, I took the critics' comments into consideration and perhaps the program could have been edited further. Perhaps the building footprint could have been smaller for less impact on the landscape.

In conclusion, I believe that if regenerative architecture is the upcoming standard for the next few years, according to research, then it is worth re-examining the roles and responsibilities of the Architect. I disagree with comments stating that we should steer away from areas we know nothing of. Though much of these technical aspects are not a part of our expertise, if we are design leads we must at least be involved in strategic efforts to make regenerative architecture a possibility for the future.

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Figure 29

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Figure 30 (Adapted)

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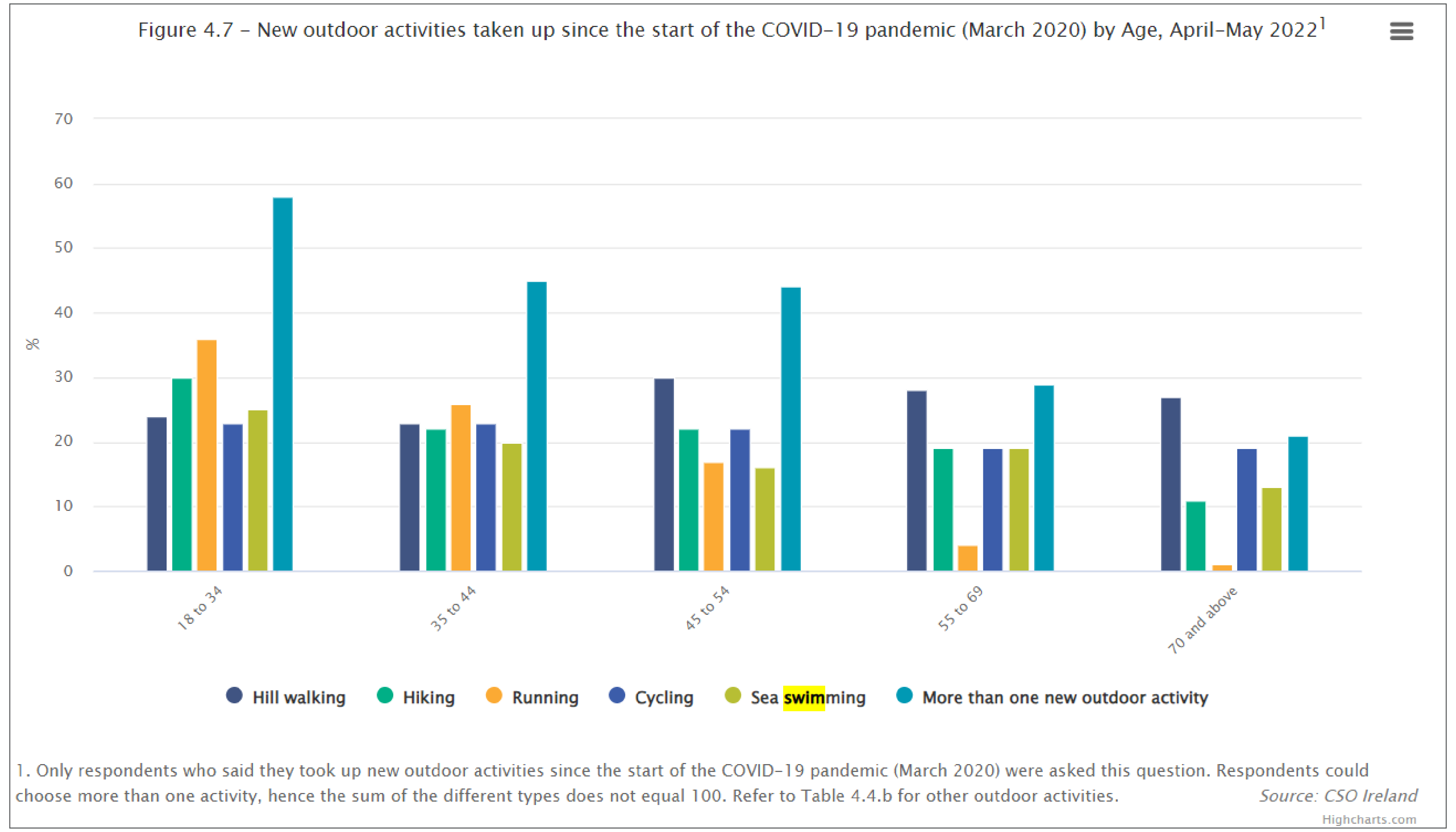
APPENDIX A: NEW OUTDOOR ACTIVITIES TAKEN UP SINCE THE START OF COVID-19



APPENDIX B: SUSTAINABILITY PARADIGMS INFLUENCING ARCHITECTURE

Table 2.1 Sustainability paradigms influencing architecture in 20th and 21th century

Paradigm	Years	Influencer	Paradigm
Bioclimatic architecture	1908–1968	Olgyay, Wright, Neutra	Discovery
Environmental architecture	1969–1972	Ian McHarg	Harmony
Energy conscious architecture	1973–1983	AIA, Balcomb, ASES, PLEA	Energy efficiency
Sustainable architecture	1984–1993	Brundtland, IEA, Feist	Resource efficiency
Green architecture	1993–2006	USGBC, Van der Ryn	Neutrality
Carbon neutral architecture	2006–2015	UN IPCC, Mazria	Resilience
Regenerative architecture	2016–Future	Lyle, Braungart, Benyus	Recovery

APPENDIX C: ENGAGED WRITING

Engaged Writing Submission
Daneisha Shanice Pile

- DCC Development Plan 2022-28, Chapter 9: Sustainable Environmental Infrastructure and Flood Risk
- Relevant Strategic Policy Committee: Climate Action, Environment and Energy
- Interested areas: Environmental protection, environmental sustainability, Surface water drainage.

Figure 1 Drainage maps acquired from Dublin City Council for Tolka Valley Park and its surroundings. Surface runoff outfalls highlighted in red.

The site for my final thesis is situated within Tolka Valley Park, Finglas, with specific focus on the river Tolka. I believe that Chapter 9: Sustainable Environmental Infrastructure and Flood Risk, within the DCC Development Plan 2022-28, most relevantly relates to my thesis' key aspect of city and human relationship with rivers and potential for regenerative interventions, as well as accompanying research.

In 1999, an intervention in the form of an integrated constructed wetland was introduced to address foul drainage misconnections and domestic effluents. This was the result of poor management in the northern Finglas area. The project aimed to attenuate pollutants and reduce malodors in order to enhance the amenity value of the site by creating of a new park with a wetland and pond for local biodiversity and people. With professional monitoring, it had been documented that this strategy was successful in intercepting untreated out fallen water from the northern Finglaswood stream, managing and filtering it before entering the river Tolka. Though this was a success, it is only in isolation. The river Tolka, as a whole, is unfortunately categorized under water quality classes "Q2 to Q3", which denote a poor state, as of the last EPA river quality survey conducted in 2019. This can be attributed to upstream over-urbanization and continued pollution from surface run-off. Surely, the success of the integrated constructed wetland strategy can provide a catalyst in further learning about how sustainable urban drainage strategies (SUDs) can assist in river regeneration.

In addition to these findings, I became quite interested in another human relationship aspect with the river Tolka. Along the lower western quadrant, there occupied a public outdoor swimming pool built by Dublin Corporation in the 1940s. It was where children gathered, and it was fed by the water of the river. The water back then must have been of appropriate bathing quality for this to occur; children even bathed in the river itself on the outskirts.

Currently within the site of interest, there are 14 untreated surface water outfalls from residential and industrial areas, flowing directly to the river. It is my belief that each outfall should and can be intercepted and treated by strategically designed methods of SUDs, whilst also providing a recreational amenity to the community. Presently, the area is stigmatized as an unsafe place due to past illegal dumping and other criminal activities. According to the Finglas Strategy Baseline Analysis Report 2021, increased use of the park is recommended. In support of my proposal, chapter 9.5.2 (Urban Watercourses and Water Quality) of the Development Plan, outlines relevant objectives SI08 and SI09. These relate to river restoration strategies to improve the river corridor, addressing water quality, ecology, and amenity, as well as planning for surface water management.

I believe that there is a current need by the community, for a facility to combat anti-social behaviour, erase the perceived divide between localities due to the valley's edges, and liven up the desolate nature of Tolka Valley Park. I advocate for an environmentally unintrusive, revived recreational indoor/outdoor bathing facility which combines with a water management strategy to address the river's current problems of pollution.

APPENDIX D: DUBLIN CITY DEVELOPMENT PLAN (2022-2028) CHAPTER 9.5.2 (NATURAL WATER COURSES & WATER QUALITY)

It is an Objective of Dublin City Council:	
SIO8	River Restoration Strategies/ Masterplans To prepare river-specific restoration strategies/ masterplans for the City's rivers and their tributaries in order to create a comprehensive, collaborative and integrated catchment management planning approach to improving the river corridor which addresses water quality, flooding, hydromorphology, ecology, biodiversity, heritage, amenity and tourism.
SIO9	Planning for Surface Water Management To undertake Surface Water Management Plans for each river catchment and as part of this, include a study of relevant zoned lands within the City in order to ensure that sufficient land is provided for nature-based surface water management, SuDS and green infrastructure.

APPENDIX E: FAUNA, HABITAT & FOOD

	FAUNA	STATUS	HABITAT	FOOD	INTERACTION WITH HUMANS	ARCHITECTURAL OPPORTUNITIES
1	Otter	Protected	River edges. The point where freshwater enters a sheltered waterbody.	Aquatic organisms	Highly secretive. No interaction.	Under bridge where treated water outfalls to river
2	Daubenton's bat	Protected	Woodlands. Roosts close to rivers or canals in places such as stone bridges, ruins, trees, and cellars.	Insects that fly over water	No interaction. Only aggressive when provoked.	Roofs, cellars, new trees
3	Kingfisher	Protected	Along banks of slow-flowing rivers and canals	Small fish like minnow and large water insects	Typically afraid	Natural swimming pool
4	Minnow	Native	Almost all freshwater habitats	Mosquitoes, dead and rotting organisms and algae	Interactive. Calm and not aggressive.	Natural swimming pool. Water filtration.
5	Hedgehog	Protected	Woodland edges, hedgerows and suburban habitats. Nests in thick hedges and bramble bushes.	Invertebrates	Solitary. No interaction.	Cellars
6	Common frog	Protected	Close to damp freshwater habitats	Insects and invertebrates	Reclusive. Rare interaction.	Natural swimming pool
7	Moorhen	Native	Any freshwater habitat with abundant emergent vegetation	Water plants, grasses, insects, invertebrates and small fish	Reclusive. Rare interaction.	Natural swimming pool
8	Monarch butterfly	Native	Prairies, meadows, grasslands	Nectar from flowers	Interactive, but fearful of being touched.	Green roof
9	Honeybee	Native	gardens, woodlands, orchards, meadows and anywhere with flowering plants	Nectar and pollen from flowers	No interaction. Only aggressive when provoked.	Green roof

CONCLUSIVE NOTES: In reality, an ecological consultant, or similar, should always be appointed to advise on best ways to enhance an existing habitat